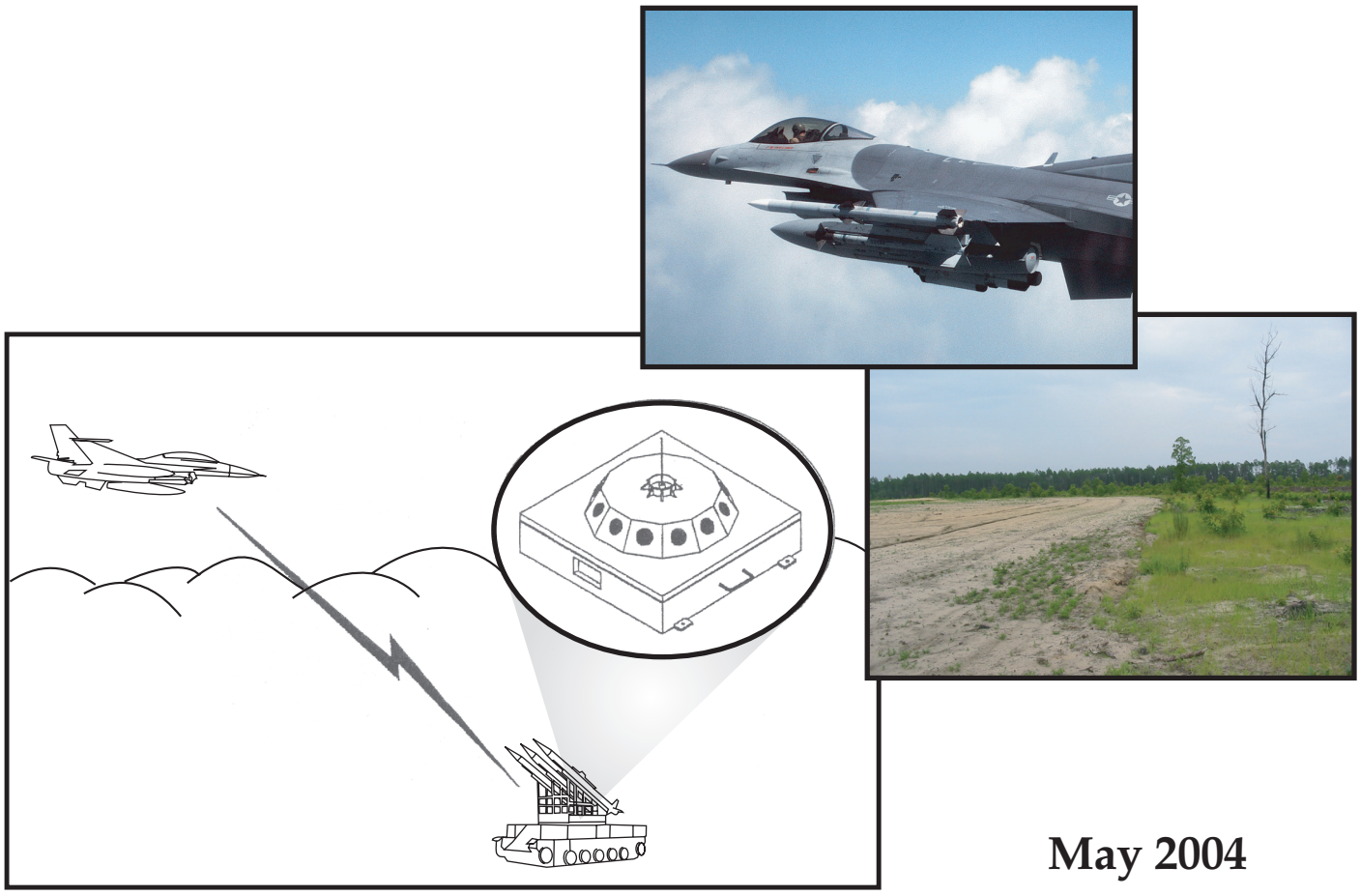
Environmental Assessment for Employment of a Mobile Laser Evaluator System (LES-M) for the 20th Fighter Wing at Shaw Air Force Base, South Carolina



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ACRONYMS AND ABBREVIATIONS

4 FW	4th Fighter Wing
20 FW	20th Fighter Wing
ACC	Air Combat Command
AEF	Aerospace Expeditionary Force
AEW	Aerospace Expeditionary Wing
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AGL	above ground level
AGM	air-to-ground missile
AIM	air intercept missile
Air Force	United States Air Force
AMU	Aircraft Maintenance Unit
ANSI	American National Standards Institute
AR	Aerial Refueling Track
ARTCC	Air Route Traffic Control Center
AT	Advanced Targeting
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
ATP	Advanced Targeting Pod
BASH	Bird-Aircraft Strike Hazard
BECR	Bombing and Electronic Combat Range
CCD-TV	charge couple device-television
CCIP	Common Configuration Implementation Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DEAD	Destruction of Enemy Air Defenses
EA	Environmental Assessment
EAF	Expeditionary Aerospace Force
EBS	Environmental Baseline Survey
ECR	Electronic Combat Range
EGBU	enhanced laser-guided bomb unit
EIS	Environmental Impact Statement
EO	Executive Order
EOD	explosive ordnance disposal
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FL	Flight Level
FLIR	Forward Looking Infrared Radar
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GBU	guided bomb unit
HAP	High Accident Potential
HARM	High-Speed Anti-Radiation Missiles
IFR	Instrument Flight Route
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
INRMP	Integrated Natural Resources Management Plan
IR	Instrument Route
JDAM	Joint Direct Attack Munition
JHMCS	Joint Helmet Mounted Cueing System
JMGT	Joint Module Ground Target
JSOW	Joint Stand-off Weapon
LES-M	Mobile Laser Evaluator System
LINK	Logistics Information Network
LRMS	Laser Range Management Software
LSTSS	large scale target sensor system
mm	millimeter
MOA	Military Operations Area
MSL	mean sea level
MTR	Military Training Route
NAS	National Airspace System
NATO	North Atlantic Treaty Organization
NCDFR	North Carolina Department of Forestry Resources
NEPA	National Environmental Policy Act
NOHD	Nominal Ocular Hazard Distance
NWR	National Wildlife Refuge
OD	Optical Density
P.L.	Public Law
PAI	Primary Aircraft Inventory
PGM	precision-guided munitions
PMAI	Primary Mission Aircraft Inventory
RCO	Range Control Officer
ROI	Region of Influence
SAM	surface-to-air missile
SEAD	Suppression of Enemy Air Defenses
SUA	Special Use Airspace
USACE	United States Army Corps of Engineers
USC	United States Code
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
UTBNI	Up To But Not Including
VFR	Visual Flight Route
VR	Visual Route
WMA	Wildlife Management Area
XR	Extended Range

FINDING OF NO SIGNIFICANT IMPACT

NAME OF PROPOSED ACTION. Employment of a Mobile Laser Evaluator System (LES-M) for the 20th Fighter Wing (20 FW) at Shaw Air Force Base (AFB), South Carolina

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES. The United States Air Force (Air Force) proposes to employ a LES-M on Poinsett Electronic Combat Range (ECR) to support simulated air-to-ground training for the 20 FW based at Shaw AFB. The proposed action would allow utilization of Advanced Targeting Pods (ATP) mounted on Shaw's primary mission aircraft, the F-16CJ. The LES-M would be sited within the Southern Target Array at Poinsett Range to enable tactical or combat mode training. The proposed action also includes use of the ATP in the training, or eye-safe mode, within the Bulldog A and B and Gamecock B, C, and D Military Operations Areas (MOAs). Employment of the LES-M on Poinsett ECR would support Shaw AFB aircrew training to meet existing and changing threats utilizing the ATP.

In addition to the proposed action, the Air Force evaluated two alternatives. Alternative A would site the LES-M for combat training at Dare County Bombing and Electronic Combat Range (BECR) in eastern North Carolina rather than Poinsett ECR. Lasing operations in the training, or eye-safe mode, would still occur within the Bulldog A and B and Gamecock B, C and D MOAs. Alternative B, the No-Action Alternative, would not deploy a LES-M to support 20 FW combat training, however lasing operations in the eye-safe mode would still occur within the MOAs. Combat-mode training with ATP- equipped F-16CJ aircraft would require deployment to locations that have LES-M or comparable capabilities.

Neither the Proposed Action nor Alternative A would require any changes in the current airspace configuration or use of Poinsett ECR (R-6002), Bulldog A and B MOAs, or Gamecock B, C, and D MOAs. Under Alternative A, training that would occur at Dare County BECR, North Carolina, would not exceed the capacity of that range, however sorties associated with Poinsett ECR would shift slightly to Dare County BECR and associated airspace.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES. The Environmental Assessment (EA) provides an analysis of the potential environmental consequences associated with the employment of the LES-M under the proposed action, Alternative A, or the No-Action Alternative. Resource areas evaluated in detail to identify potential environmental consequences include: airspace and range management, safety, biological resources, land use and environmental justice. The EA demonstrates that the proposed employment of the LES-M would not result in significant environmental consequences to any resource area.

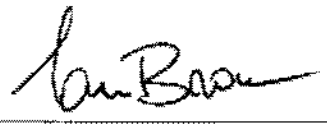
Environmental consequences resulting from implementing the Proposed Action or Alternative A would be essentially equivalent although a minor shift of fewer than 200 annual sorties to Dare County BECR would occur under Alternative A.

Use of the ATP in eye-safe mode within the MOAs would not result in safety risks to humans under the airspace. The LES-M used with the ATP in combat mode on either Poinsett ECR (Proposed Action) or Dare County BECR (Alternative A), would require range managers to define a safety footprint for use of the ATP in laser combat mode, provide that information to all range users, and otherwise ensure that safety procedures are in place.

Biological resources would not be affected by the Proposed Action, or Alternative A, since there will not be any ground disturbance or appreciable changes to sortie operations. In eye-safe mode the ATP is not expected to result in any environmental consequences to species present at either Poinsett ECR or Dare County BECR. Combat mode training would occur at existing targets or on disturbed areas within unsuitable habitat for most species. No significant environmental impacts are projected for biological resources. Results from laser use are expected to be similar for both humans and animals; with no significant impacts projected in either case.

No land use or socioeconomic impacts are expected under any of the alternatives. There would be no appreciable changes in sortie operations (that might result in measurable changes to the noise environment), and no facility or personnel changes for the Proposed Action, Alternative A, or the No-Action Alternative. Neither the proposed action, nor Alternative A, results in disproportionate adverse effects on minority persons, low-income populations, or children.

CONCLUSION. Based on the findings of the EA conducted in accordance with the requirements of the National Environmental Policy Act, the Council on Environmental Quality regulations, and Air Force Instruction 32-7061 (32 CFR 989), and after careful review of the potential impacts, I conclude that implementation of the Proposed Action or Alternative A would not result in significant impacts to the quality of the human or the natural environmental. Therefore, a Finding of No Significant Impact is warranted, and an Environmental Impact Statement is not required for this action.



THOMAS P. BROWN, Lt Col, USAF
Deputy Chief, Environmental Division

19 May 04
Date

ENVIRONMENTAL ASSESSMENT FOR EMPLOYMENT OF A MOBILE LASER EVALUATOR SYSTEM (LES-M) FOR THE 20TH FIGHTER WING AT SHAW AIR FORCE BASE, SOUTH CAROLINA

May 2004

TABLE OF CONTENTS

FIGURES

TABLES

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EXECUTIVE SUMMARY

This Environmental Assessment (EA) describes the potential environmental consequences resulting from the employment of a Mobile Laser Evaluator System (LES-M) on Poinsett Electronic Combat Range (ECR) during the 20th Fighter Wing's (20 FW) simulated air-to-ground training. The 20 FW is based out of Shaw Air Force Base (AFB), South Carolina. Use of the LES-M would enhance training and efficiency for 20 FW personnel using Advanced Targeting Pods (ATPs) mounted on 20 FW aircraft. Neither the Proposed Action nor the alternatives propose construction or a change in the number of Shaw AFB-based aircraft. A slight shift of fewer than 200 annual sorties from the Poinsett ECR to the Dare County Bombing and Electronic Combat Range (BECR) would be expected under Alternative A. For either Poinsett ECR or Dare County BECR, no significant environmental consequences are anticipated and the development of an Environmental Impact Statement (EIS) is not warranted.

ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The United States Air Force (Air Force), Air Combat Command (ACC) and the 20 FW have prepared this EA in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations implementing NEPA, and Air Force Instruction (AFI) 32-7061 (*The Environmental Impact Analysis Process*, 32 Code of Federal Regulations [CFR] 989).

PURPOSE AND NEED FOR ACTION

Deployment and use of the LES-M on Poinsett ECR would allow 20 FW aircrews to train realistically and prepare for threats faced in actual combat. The Proposed Action would allow the 20 FW to contribute substantially to the Air Force's Expeditionary Aerospace Force (EAF) Construct. Aircrews require practical experience to deliver munitions accurately, while minimizing potential collateral damage.

PROPOSED ACTION AND ALTERNATIVES

This EA analyzes the Proposed Action, Alternative A, and the No-Action Alternative.

Proposed Action: The Proposed Action consists of use of the LES-M on Poinsett ECR to support three general mission types: medium altitude laser guided bomb delivery, suppression of enemy air defenses and close air support of friendly ground troops. An LES-M unit, about the size of a large suitcase, would be mounted on a target in the Southern Target Array at Poinsett ECR. The aircraft mounted ATP unit would be set on either combat or eye-safe mode, depending on the planned training mission. The Proposed Action does not include any construction or change in military or civilian personnel, although some personnel would receive training in the use and deployment of the LES-M. The existing range contractor would place and maintain the LES-M units.

Alternative A: Deploying the LES-M on Dare County BECR, North Carolina, under Alternative A, would still allow training with the LES-M; however, the distance from Shaw AFB would

limit combat training time with the feedback provided by the LES-M. Mission goals and use of the LES-M would be the same as on Poinsett ECR: no construction or change in personnel would be required. The existing range contractor would place and maintain the LES-M.

No-Action Alternative: Under the No-Action Alternative, the LES-M would not be used for 20 FW training at Poinsett ECR. The 20 FW would continue to use the ATP laser in eye-safe mode for training within the Bulldog and Gamecock Military Operations Areas (MOAs).

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This EA analyzes the potential environmental consequences associated with use of the LES-M by the 20 FW during training missions. This analysis concludes that no significant impacts are expected under the Proposed Action, Alternative A, or the No-Action alternative.

Neither the Proposed Action nor Alternative A would require any changes in use or current airspace configuration of Poinsett ECR (R-6002), Dare County BECR, Bulldog A and B MOAs, or Gamecock B, C, and D MOAs. The ATP would be used in combat mode on either Poinsett ECR (Proposed Action) or Dare County BECR (Alternative A). This would result in a minor (fewer than 200) annual change in training missions and would require range managers to define a safety footprint for use of the laser in combat mode, and provide that information to all range users and otherwise ensure safety procedures are in place.

For the Proposed Action, Alternative A, and the No-Action Alternative, safety issues related to the LES-M are tied to training with the ATPs. While in eye-safe training mode, this laser targeting system is safe from any distance if viewed unaided and is safe from any distance in excess of 3,700 feet even with binoculars. Use of binoculars while at the target and staring up at the beam is an extremely unlikely scenario and may be discounted. Use of the ATP in combat mode must be conducted with all safety measures including safety evaluations and footprint delineation, operational constraints, documentation, and aircrew training.

Plant communities, wetlands, and surface waters would not be affected by the Proposed Action, Alternative A, or the No-Action Alternative. In eye-safe mode, the ATP is not expected to result in any environmental consequences to species present at either Poinsett ECR or Dare County BECR. Combat mode training would occur at existing targets on disturbed areas with unsuitable habitat for most species. No significant environmental impacts are projected to occur to biological resources. Hazards associated with laser training are presumed to be similar for both humans and animals; no significant impacts are projected.

Because there would be no changes in land use, staffing levels, or facilities for the Proposed Action, Alternative A, or the No-Action Alternative, no land use or socioeconomic impacts are projected.

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The United States Air Force (Air Force), Air Combat Command (ACC), proposes to employ a Mobile Laser Evaluator System (LES-M) on Poinsett Electronic Combat Range (ECR) to support simulated air-to-ground training for the 20th Fighter Wing (20 FW) based at Shaw Air Force Base (AFB), South Carolina. The LES-M would be used with Advanced Targeting Pods (ATPs) mounted on 20 FW aircraft.

Section 1.2 provides background information on the 20 FW mission and air-to-ground training using laser targeting. The purpose and need to simulate air-to-ground training using the LES-M is presented in Section 1.3. A detailed description of the Proposed Action, Alternative A, and the No-Action Alternative is provided in Chapter 2.0. Chapter 3.0 describes the existing conditions of various environmental resources that could be affected by the Proposed Action and alternatives. Chapter 4.0 describes how those resources could be affected by implementation of the Proposed Action or the alternatives. Chapter 5.0 addresses potential cumulative effects of the Proposed Action and alternatives, in conjunction with other recent past, current, and future actions that may be implemented in the region of influence (ROI).

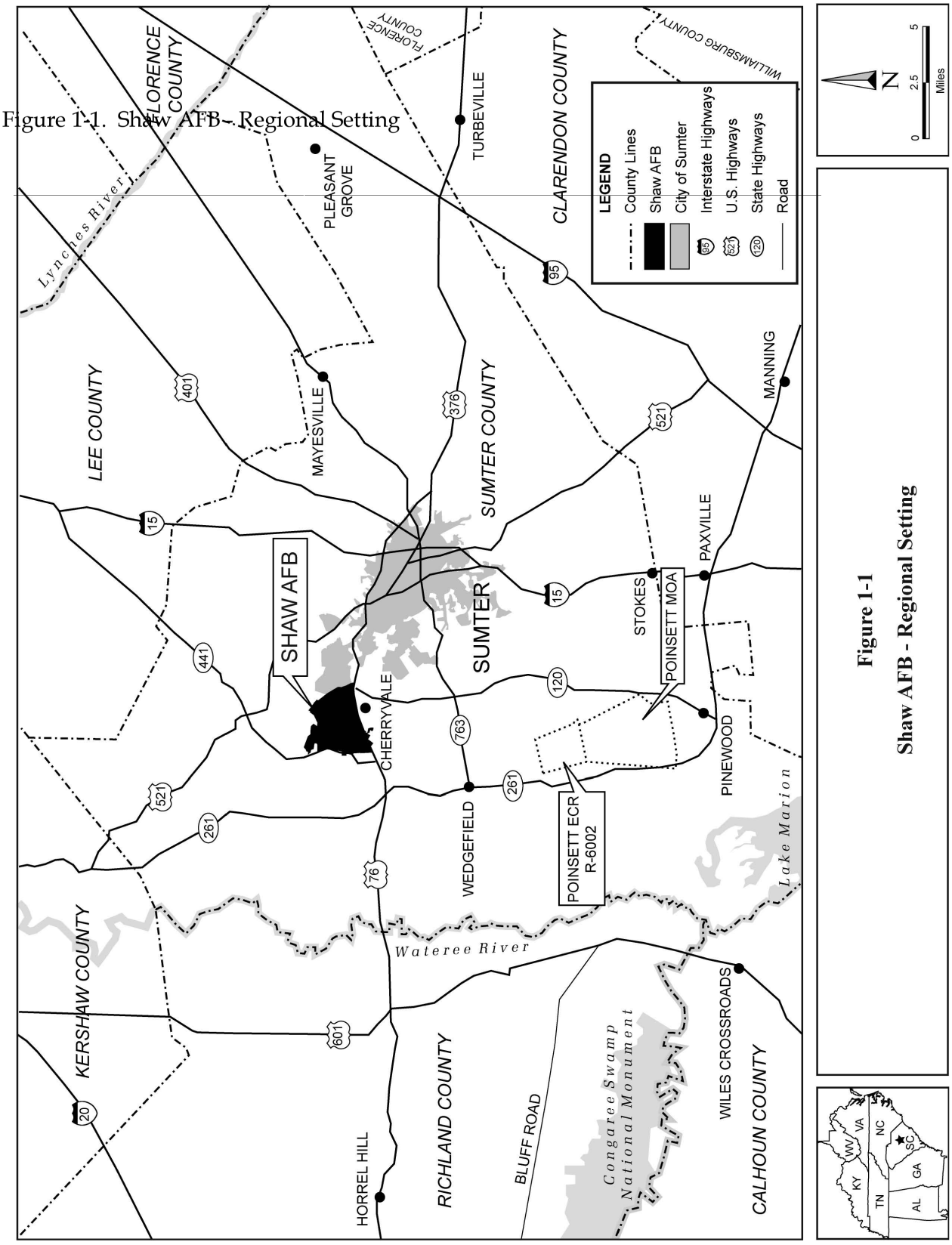
1.2 BACKGROUND

The 20 FW is based at Shaw AFB in the east central part of South Carolina, approximately 35 miles east of the capital city of Columbia. Shaw AFB is located within the city limits of Sumter and is 10 miles west of the city's center. Figure 1-1 presents the locations of the city of Sumter, Shaw AFB, and Poinsett ECR. The city of Sumter is in Sumter County, which is bounded by the Wateree River to the west and the Lynches River to the east. The county has a mixture of farmland, forested areas and wetlands, with the main population center in and around the city of Sumter. Figure 1-2 shows the airspace managed and used by Shaw AFB, including Military Operations Areas (MOAs) and Military Training Routes (MTRs) designated as Instrument Routes (IRs) or Visual Routes (VRs).

1.2.1 20 FW Mission and Training Requirements

The 20 FW operates the 55th, 77th, and 79th Fighter Squadrons, and has the primary mission to provide, project, and sustain combat ready air forces. Shaw's primary mission aircraft is the "Fighting Falcon" F-16CJ or Block 50 aircraft, a single-seat, single-engine, all-weather, multi-role tactical fighter designed to perform in both air-to-air and air-to-ground roles. The 20 FW is the host wing and the Headquarters 9th Air Force is the major tenant at Shaw AFB. The base's general goals are to sustain the resources and relationships deemed appropriate to pursue national interests, and to provide for the command, control, and communications necessary to execute the missions of the Air Force, ACC, 9th Air Force, and the 20 FW. Realistic training with the F-16CJ aircraft is essential to meet those goals.

Figure 1-1. Shaw AFB – Regional Setting



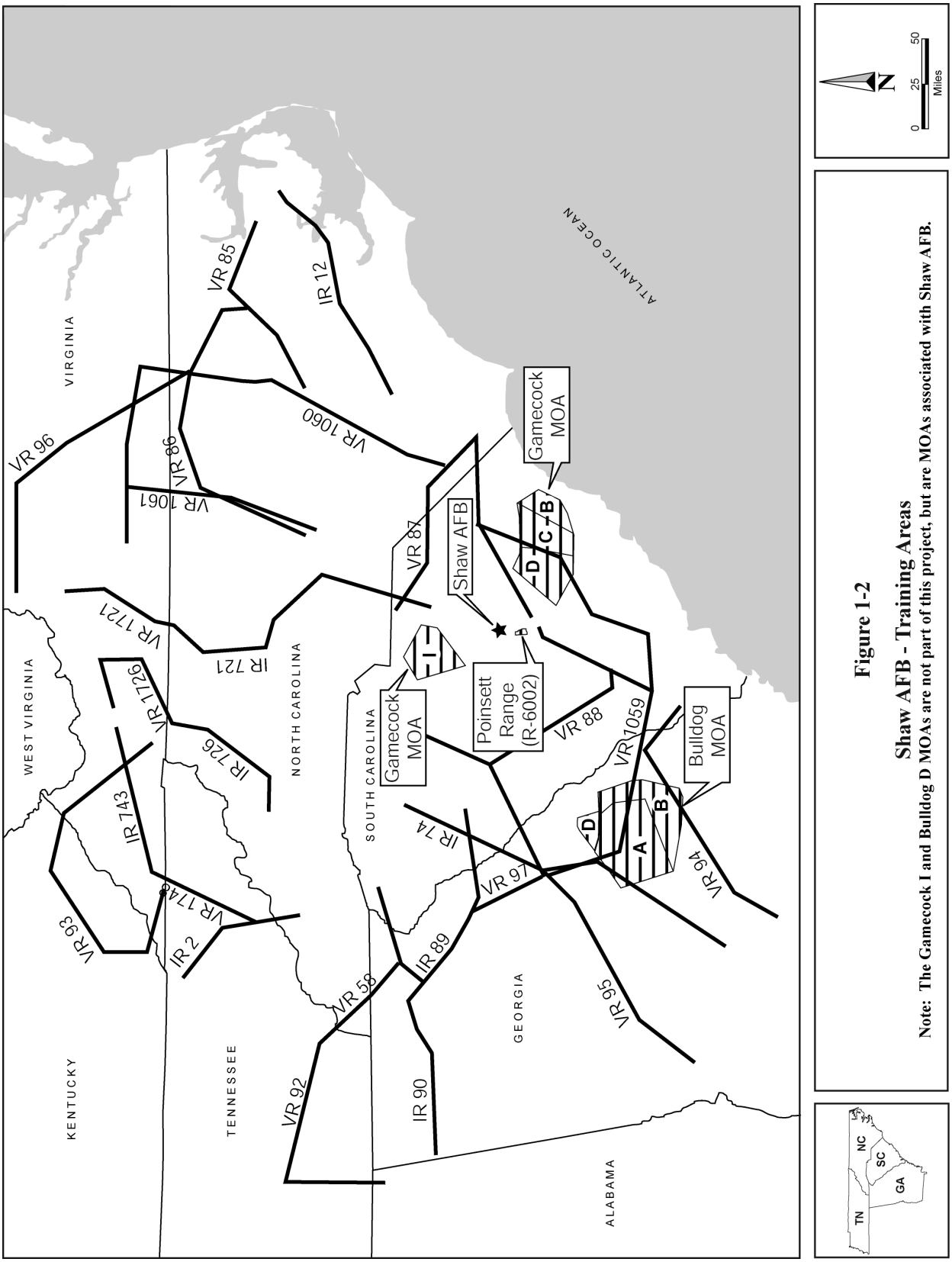


Figure 1-2

Shaw AFB - Training Areas

Note: The Gamecock I and Bulldog D MOAs are not part of this project, but are MOAs associated with Shaw AFB.

Aircrews assigned to the 20 FW must be proficient in air-to-air combat, delivery of air-to-surface munitions, Suppression of Enemy Air Defenses (SEAD) and Destruction of Enemy Air Defenses (DEAD). Training is required for each of these roles. The 20 FW training requirements include low-level instrument or visual navigation on MTRs, maneuvering for simulated air-to-air and air-to-ground training in MOAs, and air-to-ground practice in ordnance delivery on training ranges. SEAD training is accomplished by simulating or, where permitted, launching High-Speed Anti-Radiation Missiles (HARM). DEAD training utilizes laser designators to engage enemy radar systems with laser guided weapons.

1.2.2 F-16CJ Aircraft Characteristics

The original F-16 was designed as an air-to-air day fighter. New roles, new capabilities, and air-to-ground responsibilities transformed the first production F-16s into multi-role fighters with day and night capabilities. The first aircraft were designated F-16A and F-16B. The A in F-16A refers to a Block 1 through 20 single-seat aircraft; the B in F-16B refers to the two-seat version. A block is a numerical milestone. The block number increases whenever a new production configuration for the F-16 is established.

The first operational F-16A was delivered in January 1976 to the 388th Tactical Fighter Wing at Hill AFB, Utah. The single seat F-16C and two seat F-16D aircraft incorporate the latest cockpit control and display technology. All F-16s delivered since November 1981 have built-in structural and wiring provisions and systems architecture that permit expansion of the multi-role flexibility to perform precision strike, night attack and beyond-visual-range interception missions. All active Air Force units and many Air National Guard and Air Force Reserve units have converted to the F-16C/D, which is deployed in a number of block variants.

The F-16CJ stationed at Shaw AFB is a Block 50 aircraft. The F-16CJ is powered by a single F110-GE-129 turbofan engine with an afterburner and is capable of flying at twice the speed of sound (Mach 2) at operational altitudes over 50,000 feet. The F-16 has nine stations that can be used to mount additional fuel tanks, air-to-air munitions, air-to-ground munitions, or electronic warfare pods, such as the Sniper Extended Range (XR) ATP or the LITENING Advanced Targeting (AT). The F-16 is also armed with a 20-millimeter (mm) cannon mounted in the fuselage.

The F-16CJ is best recognized for its ability to employ the air-to-ground missile (AGM)-88 HARM and the AN/ASQ-213 HARM Targeting System in the SEAD mission. This specialized version of the F-16, which can also carry the ALQ-184 and ALQ-131 Electronic Jamming Pod for self protection, became the sole provider for Air Force SEAD missions when the F-4G Wild Weasel was retired from the Air Force Inventory.

1.2.3 Common Configuration Implementation Program

The Common Configuration Implementation Program (CCIP) is being undertaken to improve the combat capability of the active duty F-16 fleet. The CCIP involves the upgrade of 650 Air Force F-16 Block 50/52 and 40/42 fighters up to a single avionics configuration. The upgrade includes hardware and software upgrades.

The Block 50/52 aircraft are receiving the upgrade in phases. The first phase included the installation of a color multifunction display set and a modular mission computer to increase the pilot's situational awareness and aid in the use of air-to-air missiles that range beyond visual intercept. The second phase involves the installation of the targeting pod with laser delivery capability. The upgrade also includes installing a Joint Helmet Mounted Cueing System (JHMCS), permitting the use of air intercept missile (AIM) 9x missiles (air-to-air heat seeking), and the North Atlantic Treaty Organization (NATO) standard Logistics Information Network (LINK)-16 data link. When completed, the CCIP will permit Shaw-based F-16CJ aircraft to be fully capable to use guided bomb unit (GBU)-31 Joint Direct Attack Munitions (JDAM), AGM-154 Joint Stand-off Weapons (JSOW), and the enhanced laser-guided bomb unit (EGBU)-27. These weapons not only use laser targeting but also incorporate global positioning satellite technology to guide the weapons. Improved quality training on an ECR is needed for accurate combat use of these weapons.

1.2.4 Poinsett Electronic Combat Range

The simulated air-to-ground training using the LES-M is proposed to be conducted at the Poinsett ECR, located approximately 15 miles from the base in the vicinity of the town of Wedgefield, South Carolina. Poinsett ECR consists of a bombing/gunnery complex referred to as Poinsett Weapons Range and an Electronic Combat complex. Poinsett Weapons Range is a night-capable Class A[1] conventional range that encompasses 12,520 acres of which 1,037 acres are actual target areas. The target areas have been designated as the Northern and Southern Target Arrays. The Air Force certified the Northern Target Array for man-transportable laser systems and the Southern Target Array for aircraft-mounted lasers (LANTIRN and LITENING II) in accordance with certification guidelines (Air Force 2002a). The LES-M is proposed to be used on the Southern Target Array.

1.2.5 Proposed Employment of the Mobile Laser Evaluator System and an Advanced Targeting Pod

The LES-M is designed to provide training support for airborne laser designators such as the Sniper XR or LITENING AT described below. The LES-M provides real-time closed-loop training and is a portable system approximately the size of a large suitcase (Figure 1-3). The LES-M transmits a tone on a radio frequency whenever the LES-M is effectively illuminated by a laser designator or ATP to be carried by the F-16CJ. This

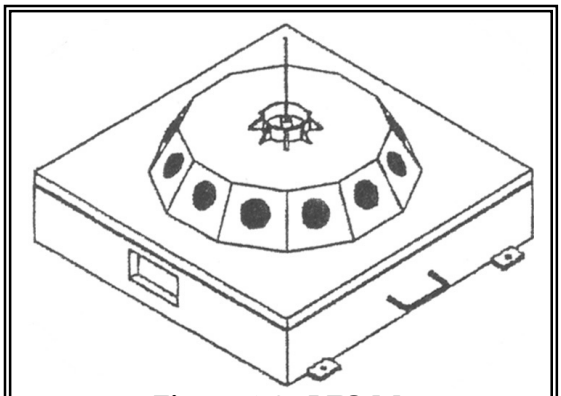


Figure 1-3. LES-M.

[1] A Class A range is manned, has a ground-based scoring capability, and has a Range Control Officer (RCO) who controls aircraft using the range. (AFI 12-212, Volume 1, Paragraph 1.3.5.1).

radio tone is transmitted on a pre-assigned frequency and provides the airborne laser operator, or any personnel conducting training oversight, the ability to evaluate targeting success. The LES-M provides immediate and continuous feedback to the pilot and permits high quality training without the use of munitions.

The LES-M measures 24 inches square with a height of 14 inches and may be installed on, or co-located with, any target authorized for laser use. The system has a 360-degree field of view, allowing simple installation and realistic training. The LES-M is ready for 20 FW training when it is set up at the desired target point, with its antenna assembled and power connected.

Sniper XR ATP and Sniper XR ATP mounted on F-16CJ.

As part of the CCIP, the 20 FW's F-16CJ will receive an ATP such as the Sniper XR or the LITENING AT targeting pod. These ATPs would be assigned to Shaw AFB on a periodic basis. The 20 FW pilots would use the ATP laser in real-world combat situations to target and, in conjunction with precision-guided munitions (PGMs), to destroy enemy forces. The ATPs are designed for current and future fighter aircraft and incorporate a high-resolution, mid-wave 3rd generation Forward Looking Infrared Radar (FLIR) sensor, a dual-mode laser, and a charge couple device-television (CCD-TV) along with a laser spot tracker and a laser marker to improve target detection and identification. The advanced image processing algorithms are combined with stabilization techniques to deliver improved performance. The ATPs are fully compatible with the latest standoff weaponry and provide automatic tracking and laser designation of tactical size targets via real-time imagery presented on cockpit displays. The F-16CJs at Shaw AFB are authorized to be so equipped to meet mission requirements for accurate targeting.

LITENING AT and LITENING AT mounted on F-16CJ.

Use of the LES-M for training is consistent with CCIP hardware and software upgrades. Aircrews assigned to the 20 FW would train with the new ATP lasers in existing training airspace currently used by the unit (Figure 1-2). When used in the MOA airspace, power output of the laser would be limited to the training, or eye-safe mode. When

used on an ECR, the ATP laser would be set for tactical, or combat mode, to receive feedback from the LES-M.

1.3 PURPOSE AND NEED

The purpose of this action is to deploy the LES-M on Poinsett ECR so that Shaw AFB aircrews can train to meet existing and changing threats and to become experienced in using the ATP in all weather conditions. This advanced training is needed to provide increased capability to the Air Force's Expeditionary Aerospace Force (EAF) Construct. The EAF Construct grew out of the requirement that the United States deploy forces worldwide despite the reduction in United States overseas basing and personnel. Under the EAF, the Air Force has divided its forces into 10 Aerospace Expeditionary Forces (AEFs) and two Aerospace Expeditionary Wings (AEWs). An AEF is a "packaged" group of different types of aircraft with a mix of capabilities suited to deployment to overseas locations for about 90 days. Each AEF consists of wings or squadrons from multiple United States bases that may operate as a unit or be integrated with other forces overseas. Pre- and post-deployment integrated training may be conducted at locations other than a "home" base for another 30 days out of the year. Rotating squadrons or wings into the AEF program on a 15-month cycle makes worldwide deployments more predictable and manageable.

Operations in Kosovo and Afghanistan emphasized the need for training with precision targeting and weapons delivery capabilities. The Air Force identified a need to launch PGMs from higher altitudes and at longer ranges to avoid enemy surface-to-air missiles (SAMs). Concurrently, the targeting of munitions must be performed with increasing accuracy to avoid, whenever possible, collateral damage. These requirements and mission needs have been addressed by the employment of third generation FLIR pods, such as the Sniper XR or the LITENING AT. These third-generation pods provide higher resolution, greater sensor stability, and better target identification. Thus aircrew and aircraft safety are improved and collateral damage is minimized, because precision systems reduce the time it takes to locate, identify, and accurately kill a target. Pilots keep out of reach of threatening air defenses with increased standoff range. The 20 FW F-16CJ aircrews need to train with precision systems that include laser targeting and simulated employment of PGMs.

The 20 FW F-16 CJ aircraft will receive an ATP on a periodic basis. Aircrews trained with this pod will be able to detect and identify targets at significantly longer ranges and deliver PGMs on target. The 20 FW aircrews reach operational capability with this system through training in the employment of the targeting laser. The 20 FW F-16CJ equipped with an ATP and piloted by personnel proficient in laser targeting becomes a formidable weapons system. This proposed use of the LES-M at Poinsett ECR would permit 20 FW aircrews to receive rapid feedback on lasing success thus enhancing training efficiency and honing required mission skills.

Training with the CCIP upgrades is proposed to be accomplished at Poinsett ECR with simulated targets using the LES-M. This training helps 20 FW aircrews develop better target identification and to more accurately deliver munitions from greater distances with greater safety to aircrews and less potential for collateral damage.

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2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action and alternatives for employing a Mobile Laser Evaluator System (LES-M) for training activities with an Advanced Targeting Pod (ATP). The Proposed Action is to deploy the LES-M at Poinsett Electronic Combat Range (ECR) located in Sumter County near Shaw Air Force Base (AFB), South Carolina (Figure 2-1). Aircraft equipped with an ATP would use the LES-M for training with the laser set in combat mode. The ATP laser would be set in eye-safe mode for training in the Bulldog A and B and Gamecock B, C and D Military Operations Areas (MOAs). Alternative A would involve training in Bulldog A and B and Gamecock B, C and D MOAs in eye-safe mode and deploying the LES-M to Dare County Bombing and Electronic Combat Range (BECR) in eastern North Carolina for combat training. Alternative B, the No-Action Alternative, would not deploy an LES-M to support 20th Fighter Wing (20 FW) combat training. Training with ATP equipped F-16CJ aircraft using the laser in the eye-safe mode would occur within the Bulldog A and B and Gamecock B, C and D MOAs, but without the benefit of electronic feedback from the LES-M during range lasing operations.

2.1 PROPOSED ACTION

The Proposed Action deploys the LES-M at Poinsett ECR to support 20 FW training. In a typical deployment, the LES-M would be mounted on a Joint Module Ground Target (JMGT) located in the Southern Target Array at Poinsett ECR.

Laser training operations would occur during normal training sorties and would be accomplished within the existing airspace utilized by Shaw AFB (Figure 1-2). No new airspace would be developed for LES-M training. LES-M training on Poinsett ECR would be conducted with the ATP laser set in combat mode; lasing operations outside range boundaries and restricted airspace would be conducted with the ATP laser set in the eye-safe mode.

2.1.1 Aircraft Operations

Squadrons from the 20 FW would operate as they do today in existing airspace. Training would occur during F-16CJ operations. Aircraft operations are described in this Environmental Assessment (EA) by two terms: sortie and sortie-operation. Each has a distinct meaning and commonly applies to a specific set of activities in particular airspace areas:

- A sortie consists of a single military aircraft flight from takeoff through its mission and is completed upon landing.
- A sortie-operation is defined as the use of one airspace unit (such as a MOA or a restricted airspace over a range) by one aircraft. Sortie-operations apply to flight activities outside the aerodrome. This means that if a single aircraft conducts one sortie and flies in both the Bulldog A MOA and the Gamecock C MOA, that aircraft would conduct two sortie-operations.

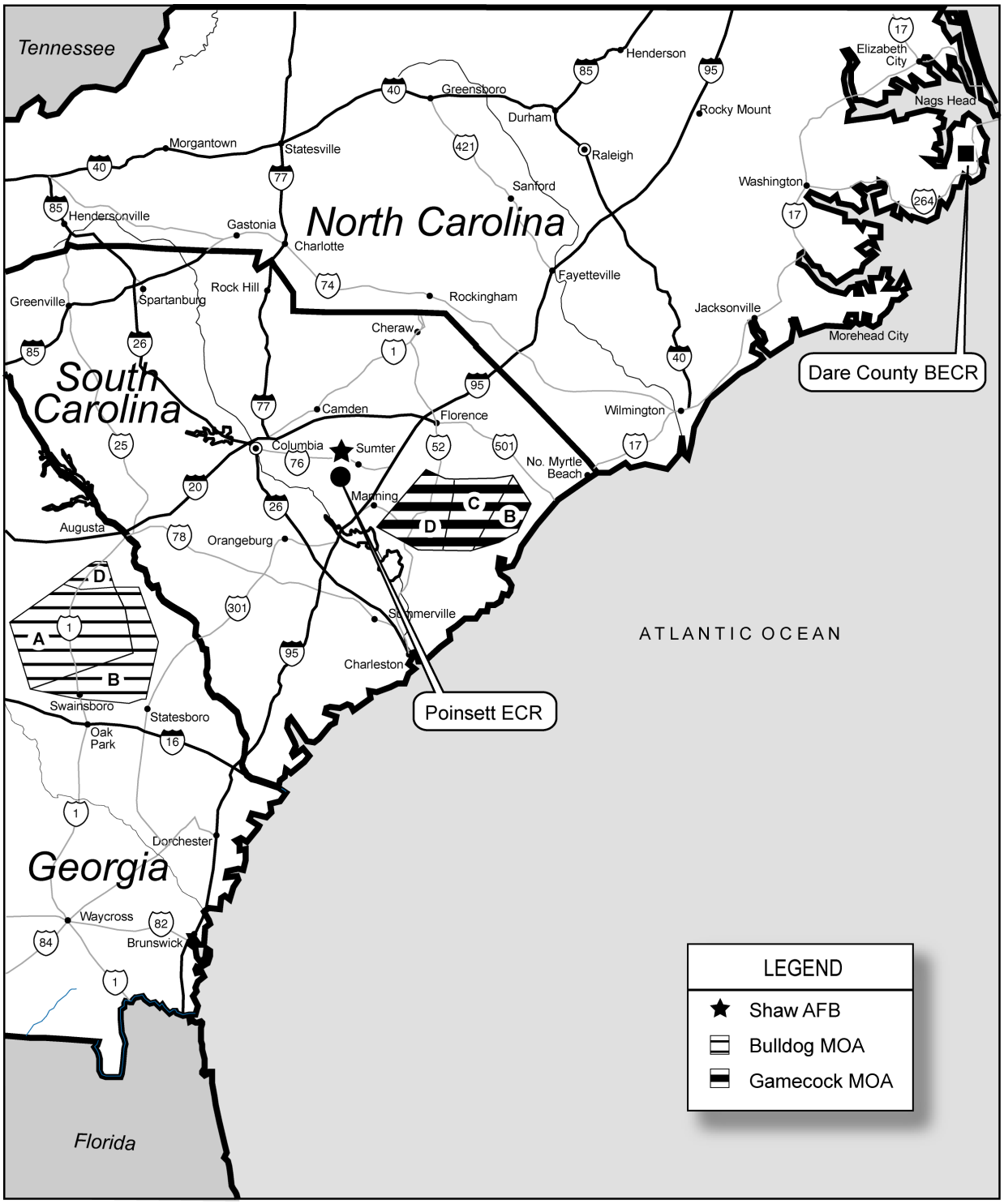


Figure 2-1

Mobile Laser Evaluator System (LES-M)
Proposed Action and Alternative A Locations

The 20 FW trains for air-to-air combat in MOAs and offshore Warning Areas located along the Eastern seaboard. Figure 2-1 identifies five MOAs (Gamecock B, Gamecock C, Gamecock D, Bulldog A and Bulldog B) where sortie-operations are conducted by the 20 FW for training. Sortie-operations along Military Training Ranges (MTRs) occur in eight Instrument Routes (IRs) and 17 Visual Routes (VRs) as presented in Figure 1-2.

The 20 FW uses the Poinsett ECR (Figure 2-2) and its associated restricted airspace (R-6002) for air-to-ground training activities. Restricted airspace designates airspace in which training activities present potential hazards to nonparticipating aircraft. This airspace currently supports approximately 4,900 sortie-operations annually, with F-16s using 3,400 sortie-operations for air-to-ground training in ordnance delivery (Appendix A).

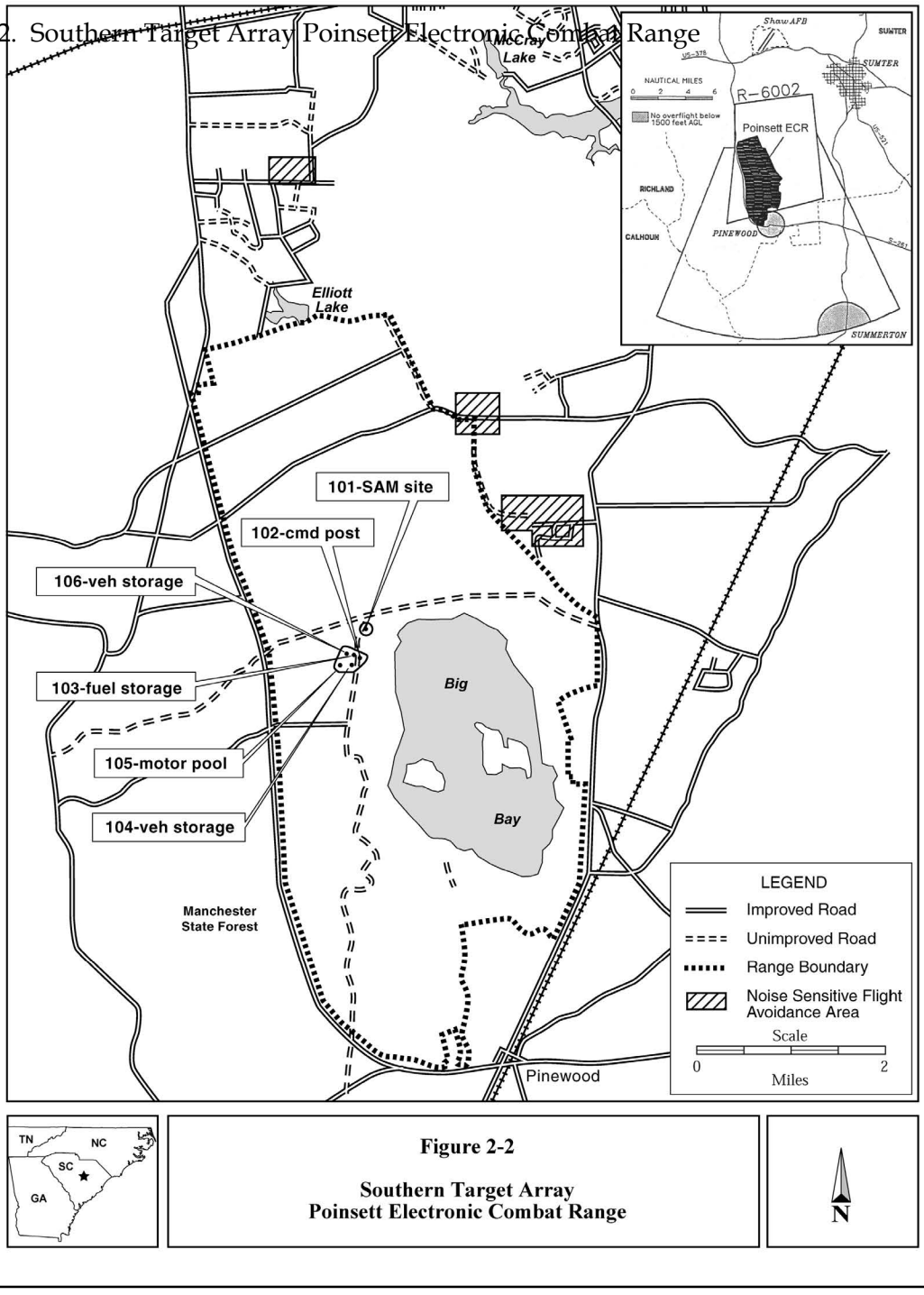
2.1.2 Proposed Training with the Mobile Laser Evaluator System

The LES-M would be mounted on a JMGT within the Southern Target Array at Poinsett ECR to support the proposed training sorties described below.

Aircraft would use the LES-M on Poinsett ECR to simulate three general mission types:

1. Medium Altitude Laser Guided Bomb Delivery. Training with the LES-M would consist of medium altitude (above 5,000 feet above ground level [AGL]) attack on a fixed or semi-mobile target with a satellite or laser guided bomb. The attack starts at a range of 10 to 30 miles, the LES-M target is acquired using the ATP, and a simulated munition is dropped 6 to 9 miles from the target. Target lasing would continue on the LES-M for the 30 to 60 seconds it would take for the simulated munition to reach the targeted LES-M. The aircrew receives cockpit feedback of lasing effectiveness from the LES-M.
2. Suppression of Enemy Air Defenses. Training with the LES-M consists of medium altitude engagement of an electronic emitter co-located with the LES-M on Poinsett ECR. Aircrew flying above 5,000 feet AGL would locate an electronic threat utilizing on-board electronic instrument capabilities. The ATP would then be used to visually locate and simulate an attack on the target. The LES-M would provide cockpit feedback of the success of the laser targeting.
3. Close Air Support of Friendly Ground Troops. This training would simulate friendly ground troops engaged with enemy ground forces. The mobile LES-M would be located with "enemy" ground forces and the ATP would be used to locate the ground target and guide delivery of simulated laser or satellite-guided munitions. The LES-M would provide immediate feedback on the success of the lasing operations.

Figure 2-2. Southern Target Array Poinsett Electronic Combat Range



2.1.3 Proposed Training in Military Operations Areas

To enhance training opportunities with the ATP, pilots would conduct missions similar to those identified above within the confines of the existing Gamecock and Bulldog MOAs. When conducting missions within these airspaces, pilots would use the ATP laser in the training or eye-safe mode. Pilots would develop a mission within the existing airspace by identifying potential simulated targets beneath these airspaces. During a typical training sortie-operation, the F-16CJ pilot would use the ATP to select and simulate an attack on a pre-designated target. Use of the ATP in the training or eye-safe mode within these existing airspaces would provide pilots with a variety of targets and expand aircrew training beyond the approaches and combat targets provided by Poinsett ECR.

2.1.4 Facility and Other Requirements

Use of LES-M would not require construction activity at either Shaw AFB or Poinsett ECR. Similarly, the use of ordnance and chaff and flare would not change under the Proposed Action. Use of the LES-M permits high quality training without using ordnance.

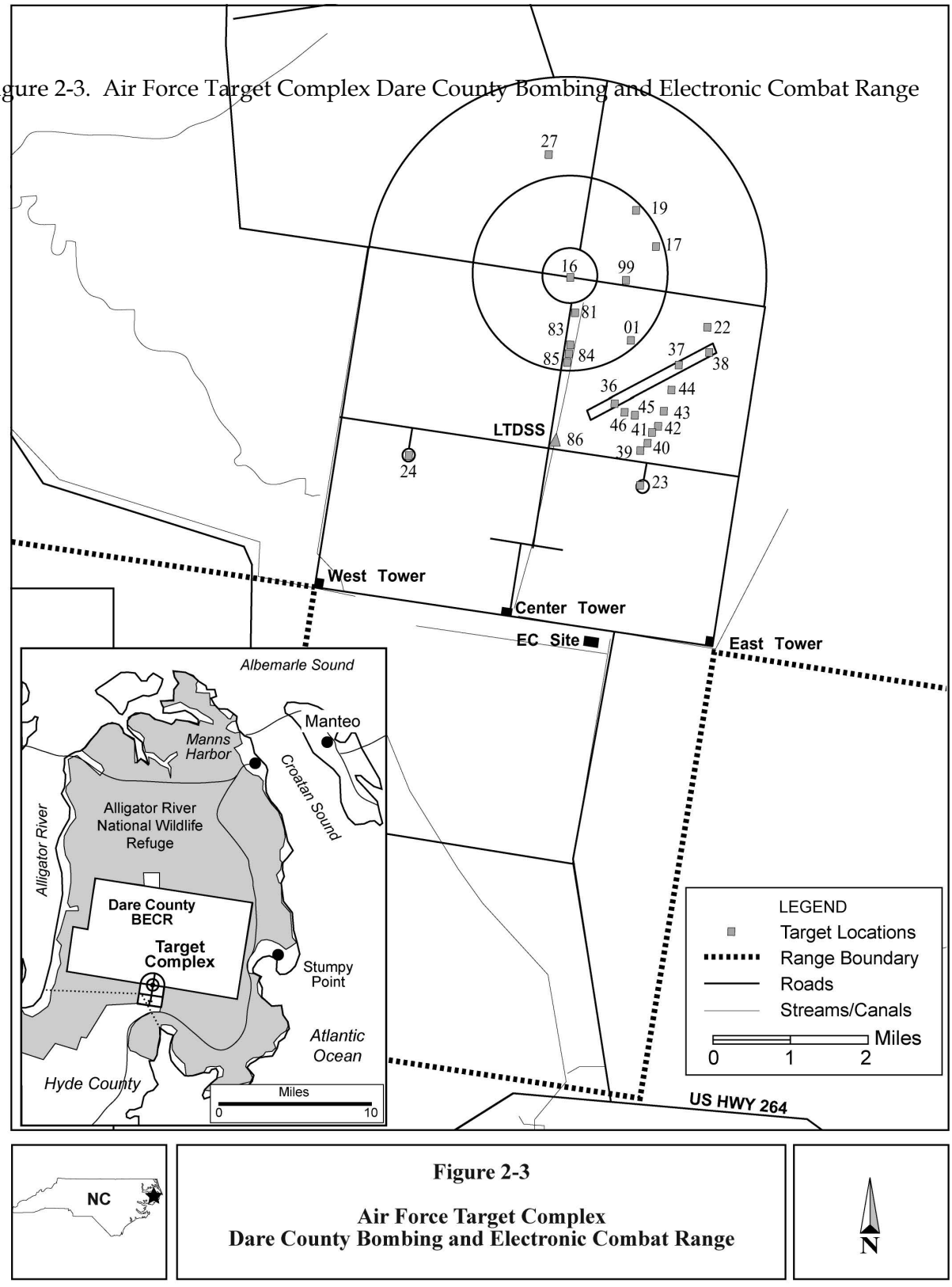
Shaw AFB currently supports approximately 6,000 full-time military and civilian personnel. Placement and maintenance of the LES-M would be the responsibility of the existing range contractor. Some additional personnel training may be required in use and deployment of the LES-M, but manpower requirements would not change as a result of this action.

2.2 ALTERNATIVE A

If the LES-M were not deployed on Poinsett ECR, some degree of training for the 20 FW could be achieved through Alternative A, deployment of the LES-M to Dare County BECR in eastern North Carolina (Figure 2-1). An LES-M has been previously used at Dare County BECR and a large scale target sensor system (LSTSS) remains there for combat laser systems. The Dare County BECR is a joint United States Air Force (Air Force)/Navy Weapons Range, with the Air Force being the host. The range, managed by the 4th Fighter Wing (4 FW) at Seymour Johnson AFB in Goldsboro, North Carolina, is divided so that the Air Force uses the airspace in the south and the Navy uses the airspace in the north. Dare County BECR is a three tower, Class A range containing a variety of targets dispersed throughout the range complex including conventional targets, heavyweight ordnance targets, multiple tactical laser targets, and a strafe pit (Figure 2-3). Over the past seven years the range has supported an annual use of approximately 9, 500 sortie-operations with F-15E aircraft from Seymour Johnson AFB being the primary users. Currently, the 20 FW does not use Dare County BECR on a regular basis.

The LES-M would be deployed to existing targets (depicted numerically on Figure 2-3) with the exception of Target 17, which is not suitable for laser use. It is estimated that approximately five percent of the sortie-operations currently flown into Poinsett ECR, for an annual total of fewer than 200 sortie-operations, would be conducted by the 20 FW at Dare County BECR (Appendix A). Aircraft equipped with an ATP would fly at medium altitude direct from Shaw AFB to Dare County BECR to use the LES-M. The ATP laser would be used in the combat mode

Figure 2-3. Air Force Target Complex Dare County Bombing and Electronic Combat Range



while the aircraft is within existing restricted airspace (R-5314). No construction activity would be required to support deployment of the LES-M at Dare BECR.

Use of Dare County BECR would allow only minimal training with the LES-M. Because of the distance from Shaw AFB, the number of sortie-operations possible at Dare County BECR are minimum projections and therefore would not permit 20 FW aircrews to achieve the proficiency possible with regular training feedback at the nearby Poinsett ECR. Mission use and other requirements would be the same as at Poinsett ECR. Deployment and maintenance of the LES-M at Dare BECR would be conducted by the existing range contractor.

2.3 ALTERNATIVE B: NO-ACTION ALTERNATIVE

Under Alternative B, the No-Action Alternative, the deployment of an LES-M at Poinsett ECR to support 20 FW training would not take place. The F-16CJ would still be periodically configured with an ATP and would continue to use practice ordnance on Poinsett ECR. Training in eye-safe mode without the feedback of the LES-M would be conducted in the Bulldog A and B and Gamecock B, C and D MOAs. More extensive combat training would require transits to areas that have feedback systems such as the LES-M.

2.4 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The environmental impact analysis process includes the review of all information pertinent to the Proposed Action and alternatives, and provides a full and fair discussion of potential consequences to the natural and human environment. The process includes involvement with the public and agencies to identify possible consequences of an action, as well as the focusing of analysis on environmental resources potentially affected by the Proposed Action or alternatives.

2.4.1 Scope of Resource Analysis

The proposed use of a combat laser targeting and feedback system has the potential for effects to certain environmental resources. Specific environmental resources with the potential for environmental consequences include airspace and range management, safety, biological resources, land use, and environmental justice. As noted in Section 2.0, the LES-M would not be deployed under the Bulldog MOA or the Gamecock MOA, although training with the ATP set on eye-safe mode would occur in these MOAs. Potentially affected environmental resources on lands underlying the Gamecock and Bulldog MOAs are also analyzed. Since aircraft activity in the affected airspace would not appreciably change, noise and air quality would not be materially affected by the Proposed Action or Alternative A. Neither the Proposed Action nor Alternative A involves construction or ground-disturbing activities or change in manpower and thus would have no effect on cultural resources, visual, hazardous waste, earth, water or socioeconomic resources. Both the South Carolina and Georgia State Historic Preservation Offices have concurred that no historic properties will be affected by the Proposed Action or Alternative A.

Chapter 3.0 presents the affected environment for airspace and range management, safety, biological resources, land use, and environmental justice. Since the focus of the activity would be at either Poinsett ECR or Dare County BECR, the region of influence (ROI) for these

resources is predominantly those ranges. Discussion of MOAs is also included, since laser training in the eye-safe mode would occur in these areas. Chapter 4.0 presents analysis of potential consequences to these environmental resources. Section 2.5 presents a comparison of environmental consequences.

2.4.2 Public and Agency Involvement

Agency consultation letters were sent to interested parties regarding this project to ensure compliance with applicable regulations, specifically the Endangered Species Act (ESA).

To facilitate public involvement in this project, the Air Force published newspaper advertisements announcing the availability of the Draft EA for public and agency review. The Air Force also published an advertisement announcing the availability of the Final EA. In addition, the 20 FW Public Affairs Office distributed news releases to their media outlets and posted both the Draft and Final EA on the Shaw AFB public website at www.shaw.af.mil.

2.4.3 Regulatory Compliance and Permit Requirements

This EA has been prepared to satisfy the requirements of the National Environmental Policy Act (NEPA) (Public Law [P.L.] 91-190, 42 United States Code [USC] 4321 *et seq.*) as amended in 1975 by P.L. 94-52 and P.L. 94-83. The intent of NEPA is to protect, restore, and enhance the environment through well-informed federal decisions. In addition, this document was prepared in accordance with Section 102 (2) of NEPA, regulations established by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1500-1508), and Air Force Instruction (AFI) 32-7061, (i.e., 32 CFR Part 989).

Implementation of the Proposed Action or alternatives would require coordination with several regulatory agencies. Compliance with the ESA involves communication with the Department of the Interior (delegated to the United States Fish and Wildlife Service [USFWS]) in cases where a federal action could affect threatened or endangered species, species proposed for listing, or designated critical habitat for listed species. No adverse effects are anticipated. Letters were sent to the appropriate USFWS offices as well as state agencies, informing them of the Proposed Action and alternatives and requesting data regarding applicable protected species. The Charleston office, West Georgia sub office, and Coastal sub office of the USFWS concurred with the determination that the Proposed Action and alternatives is not likely to adversely affect federally listed species. Appendix B includes copies of relevant coordination letters sent by the Air Force and response letters provided by the agencies.

Since no adverse effects are anticipated, further consultation is not required. Other regulatory or permit requirements are not anticipated for the Proposed Action or alternatives.

2.5 COMPARISON OF ALTERNATIVES

Table 2-1 summarizes the potential environmental consequences of the Proposed Action and alternatives, based on the detailed impact analyses presented in Chapter 4.0. Since no consequences are anticipated, no management actions are required.

Table 2-1. Summary of Potential Environmental Consequences

Resources	*Proposed Action*	*Alternative A: Dare County BECR*	*Alternative B: No-Action Alternative*
Airspace and Range Management	○	○	○
Safety	○	○	○
Biological Resources	○	○	○
Land Use	○	○	○
Environmental Justice	○	○	○

Consequences:
○ = None/No change.
+ = Beneficial or not discernible.
- = Adverse but not significant.

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3.0 AFFECTED ENVIRONMENT

This chapter describes the affected environment at Poinsett Electronic Combat Range (ECR) and Dare County Bombing and Electronic Combat Range (BECR) and the potentially affected airspace. Based on the operational characteristics of the Proposed Action (Chapter 2.0), it was determined that the following resources could possibly be affected: airspace and range management, safety, biological resources, land use, and environmental justice. The expected geographic extent of potential consequences is the region of influence (ROI) for each resource. This chapter presents the existing environmental conditions for the ROI of potentially affected environmental resources.

3.1 AIRSPACE AND RANGE MANAGEMENT

Airspace management is the direction, control, and handling of flight operations in the volume of air that overlies the geopolitical borders of the United States and its territories. Airspace is a resource managed by the Federal Aviation Administration (FAA), with established policies, designations, and flight rules to protect aircraft in the airfield and en-route environment. The FAA designates Special Use Airspace (SUA) for military and other governmental activities, and for other military training airspace. Management of this resource considers how airspace is designated, used, and administered to best accommodate the individual and common needs of military, commercial, and general aviation. Because of these multiple and sometimes competing demands, the FAA considers all aviation airspace requirements in relation to airport operations, Federal Airways, Jet Routes, military flight training activities, and other special needs to determine how the National Airspace System (NAS) can best be structured to satisfy all user requirements.

The FAA has designated four types of airspace above the United States. They are Controlled, Special Use, Other, and Uncontrolled airspace.

Controlled airspace is categorized into five separate classes: Class A, B, C, D, and E airspace. These classes identify airspace that is controlled, airspace that supports airport operations, and designated airways affording en-route transit from place-to-place. These classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace.

SUA is designated airspace within which flight activities are conducted that require confinement of participating aircraft, or place operating limitations on non-participating aircraft. Prohibited Areas, Restricted Areas, Warning Areas, and Military Operations Areas (MOAs) are examples of SUA.

Other airspace consists of advisory areas, areas that have specific flight limitations or designated prohibitions, areas designated for parachute jump operations, Military Training Routes (MTRs), and Aerial Refueling Tracks (ARs). This category also includes Air Traffic Control Assigned Airspace (ATCAA). When not required for other needs, ATCAA is airspace

authorized for military use by the managing Air Route Traffic Control Center (ARTCC), usually to extend the vertical boundary of SUA.

Uncontrolled airspace is designated Class G airspace and has no specific prohibitions associated with its use.

Range management involves the development and implementation of those processes and procedures required by Air Force Instruction (AFI) 13-212, Volumes 1, 2, and 3, to ensure that United States Air Force (Air Force) ranges are planned, operated, and managed in a safe manner, that all required equipment and facilities are available to support range use, and that proper security for range assets is present. Specific direction on different range activities is contained in AFI 13-212, Volume 1, *Range Planning and Operations*, Volume 2, *Range Construction and Maintenance*, and Volume 3, *SAFE-RANGE Program Methodology* (Air Force 2001a). The focus of range management is on ensuring the safe, effective, and efficient operation of Air Force ranges. The overall purpose of range management is to balance the military's need to accomplish realistic testing and training with the need to minimize potential impacts of such activities on the environment and surrounding communities (Air Force 2001a).

Two types of SUA are associated with the proposed training using an Advanced Training Pod (ATP) and the proposed deployment of the Mobile Laser Evaluator System (LES-M). These are:

- Restricted Areas (two), and
- MOAs (five)

The airspace ROI for the alternatives considered in this Environmental Assessment (EA) is the area encompassed by the airspace that directly supports training activities on the restricted areas and includes Poinsett ECR (R-6002) or Dare County BECR (R-5314), and the MOAs Bulldog A and B, and Gamecock B, C and D.

The ROI for range management are those geographic areas consisting of government-owned land comprising the Poinsett ECR and Dare County BECR. Dare County BECR is a joint Air Force/Navy weapons range with the Air Force being the host service. The Air Force's area of operations is in the southern portion of the complex; the Navy uses the northern portion.

3.1.1 Restricted Areas

A Restricted Area is designated airspace that supports ground or flight activities that could be hazardous to nonparticipating aircraft. Entry into restricted airspace without approval from the using or controlling agency is prohibited. Poinsett ECR is located approximately seven miles south of Shaw AFB near Wedgefield, South Carolina. Dare County BECR is situated in northeastern North Carolina approximately 135 nautical miles east of Raleigh/Durham, North Carolina.

The restricted airspace, R-6002, is provided to support training activities on Poinsett ECR; the airspace designated R-5314 supports activity on Dare County BECR. These airspace elements are described in Table 3.1-1.

Table 3.1-1. Restricted Area Identification and Description

Airspace	ALTITUDES		Controlling ARTCC
	Minimum	Maximum	
R-6002A	Surface	UTBNI [1] 13,000 MSL [2]	Jacksonville
R-6002B	13,000 MSL	UTBNI FL 180 [3]	Jacksonville
R-6002C	FL 180	UTBNI FL 230	Jacksonville
R-5314A	Surface	UTBNI FL 205	Washington
R-5314B	500 AGL [4]	UTBNI FL 205	Washington
R-5314C	500 AGL	UTBNI FL 205	Washington
R-5314D [5]	Surface	UTBNI FL 205	Washington
R-5314E [6]	Surface	UTBNI FL 205	Washington
R-5314F	500 AGL	FL 205	Washington
R-5314G	200 AGL	15,000 MSL	Washington
R-5314H	500 AGL	10,000 MSL	Washington
R-5314J	1,000 AGL	6,000 MSL	Washington

Notes:
1. UTBNI = Up to, but not including
2. MSL = mean sea level
3. FL = Flight Level. FL 180 is approximately 18,000 feet MSL
4. AGL = above ground level
5. Primary impact area for Air Force
6. Primary impact area for Navy

Sources: Air Force 1997a (Seymour Johnson Sup 1 to AFI 13-212); Air Force 2000a (Shaw Sup 1 to AFI 13-212)

3.1.2 Military Operations Area

A MOA is airspace established outside Class A airspace to separate or segregate certain non-hazardous military activities from Instrument Flight Rule (IFR) traffic and to identify for Visual Flight Rule (VFR) traffic where these activities are conducted. Class A airspace covers the continental United States and limited parts of Alaska, including the airspace overlying the water within 12 nautical miles of the United States coast, and it covers from 18,000 feet MSL up to and including 60,000 feet MSL. Vertical and lateral limits and hours of operation are defined for MOAs to separate military operations and training activities from IFR traffic. MOAs exist so the military can conduct non-hazardous training activities, such as air combat maneuvers, air intercepts, acrobatics, and low altitude tactics. They contain these activities in airspace as free as practicable from nonparticipating aircraft. MOA utilization is under the control of applicable ARTCC. Shaw Air Force Base (AFB) manages the MOAs described in Table 3.1-2 that would support the proposals considered in this EA.

Table 3.1-2. MOA Identification and Description

MOA	ALTITUDES		HOURS OF USE		Controlling ARTCC
	Minimum	Maximum	From	To	
Bulldog A [1]	500 AGL [2]	UTBNI [3] 10,000 MSL [4]	7:00 AM	Midnight	Atlanta
Bulldog B [1]	10,000 MSL	UTBNI FL [5] 180	7:00 AM	Midnight	Atlanta
Gamecock B	10,000 MSL	UTBNI FL 180	8:00 AM	Midnight	Jacksonville
Gamecock C	100 AGL	10,000 MSL	8:00 AM	Midnight	Jacksonville
Gamecock D	10,000 MSL	UTBNI FL 180	8:00 AM	Midnight	Jacksonville

Notes: 1. Bulldog A and Bulldog B are normally used together. Bulldog B overlaps all of Bulldog A and extends the higher altitude airspace to the south and east.
2. AGL – above ground level
3. UTBNI – Up to, but not including
4. MSL - mean sea level
5. FL – Flight Level. FL 180 is approximately 18,000 MSL

Source: United States Department of Transportation (USDOT) 2001, USDOT 2002, AP/1A

The Bulldog MOAs overlie northeastern Georgia; the coincident portions of the Bulldog A and B MOAs overlie four airports. Two are civil and two are private. The portion of the Bulldog B MOA extending to the south and east overlies six airports. Three are private and three are civil. One Federal Airway, V-70, transverses the southeastern portion of the Bulldog B MOA in a northeast to southwest direction.

Gamecock B, C and D MOAs overlie eastern South Carolina. The Gamecock B, C and D MOAs abut each other in an east-to-west direction. The Gamecock B MOA overlies one civil airport. The Gamecock C MOA overlies one civil and one private airport. The Gamecock D MOA overlies two civil airports. One Federal Airway, V-437, transverses the Gamecock D MOA in a north-northeast to south-southwest direction.

When not required for other FAA air traffic control, ATCAA airspace above the Bulldog B and Gamecock D MOAs provides additional vertical airspace at and above FL 180 when needed for higher altitude training tactics.

3.1.3 Range Management

Poinsett ECR and Dare County BECR are Class A ranges. Class A ranges are manned, have a ground-based scoring capability, and a Range Control Officer (RCO) who controls aircraft using the range (Air Force 2001a). Overall responsibility for the operation of Poinsett ECR and Dare County BECR rests with the commanders of the 20 FW, Shaw AFB, and the 4 FW, Seymour Johnson AFB, respectively. The Operations Group commanders of each organization exercise operational control of the ranges (Air Force 2000b).

Range operations require that the surface area encompassing the weapon safety footprints (as defined in SAFE-RANGE) be protected by purchase, lease, or other restriction to ensure the safety of personnel, structures, and the public from expended rockets, missiles, or target debris (Air Force 2001a). Additional information pertaining to the SAFE-RANGE program is contained in the Safety section of this EA. The lands associated with both Poinsett ECR and Dare County BECR Complex meet these requirements.

Range managers are required to assess risks associated with weapons employment and establish mission parameters that minimize potential safety hazards. Specific weapon safety footprints (which include both ordnance delivery and laser use) must be assessed against each intended target to ensure that they can be safely employed (Air Force 2001a). These assessments have been accomplished by 20 FW and 4 FW staff and allowable ordnance delivery profiles have been documented in applicable unit supplements to AFI 13-212 (Air Force 2000a, Air Force 1997a). Each unit's supplement to AFI 13-212 also assigns responsibilities and provides direction regarding range scheduling, maintenance, explosive ordnance disposal, and range decontamination and debris disposal.

3.2 SAFETY

Ground, explosive, and flight safety are important (activities during) operations conducted by the 20 FW stationed at Shaw AFB, South Carolina. These operations include activities at the base itself, as well as training conducted in regional SUA. Ground safety considers issues associated with operations and maintenance activities that support base operations, including fire and crash response. Explosive safety discusses the management and use of ordnance or munitions associated with airbase operations and training activities conducted in various elements of training airspace. Flight safety considers aircraft flight risks.

The ROI for safety includes Shaw AFB and its immediate vicinity, as well as those areas encompassed by regional military training airspace that would be used by aircrews from the 20 FW in performing the proposed training using the LES-M. These areas include two restricted areas that support operations on Poinsett ECR and the Dare County BECR. The five MOAs (Bulldog A and B; Gamecock B, C and D) are also discussed in conjunction with ATP training.

3.2.1 Ground Safety

Day-to-day operations and maintenance activities conducted by the 20 FW are performed in accordance with applicable Air Force safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health (AFOSH) requirements.

The 20 FW fire department provides fire and crash response at Shaw AFB. The unit has a sufficient number of trained and qualified personnel, and possesses all equipment necessary to respond to aircraft accidents and structure fires. There are no equipment or facility shortfalls; there are no fire safety waivers in effect. The unit is also party to mutual-aid agreements with the Sumter Fire Department, thus ensuring availability of additional support if required (personal communication, Spitzer 2002).

Elements of the 20 FW fire department (firefighters and equipment) are assigned to Poinsett ECR. Strict adherence to all range operating processes and procedures has minimized fire risk on the range. Fire is not considered a significant issue at Poinsett (personal communication, Spitzer 2002).

On Dare County BECR, fire-suppression responsibility is contracted to the North Carolina Department of Forestry Resources (NCDFR). High fire potential on the range normally exists in the spring (March, April, and May) and late fall-early winter (November and December). The NCDFR assesses fire risk and assigns codes based on relative severity of risk. When fire risk on the range is elevated, specific training events with the potential to ignite a fire are limited or completely curtailed.

Aircrews training on Poinsett ECR and Dare County BECR have existing authorization to use laser targeting systems in the combat mode. Bioenvironmental Safety and Health Engineers have assessed each range, and have found no specific risk associated with current laser use. At both ranges, applicable unit supplements to AFI 13-212 identify those targets where use of lasers is authorized and provide detailed procedures that must be followed by both aircrew and range staff when lasing operations are in progress. Use of specific laser pods at either range will require testing and certification prior to deployment.

3.2.2 Explosives Safety

The 20 FW controls, maintains, and stores all ordnance and munitions required for mission performance. Ordnance is handled and stored in accordance with Air Force explosive safety directives (AFI 91-201), and all munitions maintenance is carried out by trained, qualified personnel using Air Force-approved technical data. Ample storage facilities exist, and all facilities are fully licensed for the ordnance they store. No storage facility waivers are currently in effect.

Due to proximity to the installation boundary, one safety arc in the munitions storage area extends off the east side of the installation. However, no waiver is required because the Air Force has established easements with the property owner to ensure protection of the area (personal communication, Blebins 2002).

In the event of any malfunctions or other safety issues involving ordnance, trained Explosive Ordnance Disposal (EOD) personnel are stationed at Shaw AFB. These technicians would render the component safe, and then manage its final disposition.

3.2.3 Flight Safety

The primary public concern with regard to flight safety is usually the potential for aircraft accidents. Flight risks apply to all aircraft; they are not limited to the military. Aircraft accident mishaps may occur as a result of mid-air collisions, collisions with manmade structures or terrain, weather-related accidents, mechanical failure, pilot error, or bird-aircraft collisions.

The Air Force defines four categories of aircraft mishaps: Classes A, B, C, and High Accident Potential (HAP). Class A mishaps are those that result in a loss of life, permanent total disability, a total cost in excess of $1 million, destruction of an aircraft, or damage to an aircraft

beyond economical repair. Class B mishaps result in total costs of more than $200,000, but less than $1 million, result in permanent partial disability or in-patient hospitalization of three or more personnel, but do not result in fatalities. Class C mishaps involve reportable damage of more than $20,000, but less than $200,000, or a lost workday involving 8 hours or more away from work beyond the day or shift on which it occurred; or occupational illness that causes loss of work at any time. HAP represents minor incidents not meeting any of the criteria for Class A, B, or C. Class C mishaps and HAP, the most common types of accidents, represent relatively unimportant incidents because they generally involve minor damage and injuries, and rarely affect property or the public (Air Force 2001b). Class A mishaps are of primary concern because of their potentially catastrophic results.

Based on historical data on mishaps at all installations, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. It should be noted that these mishap rates do not consider combat losses due to enemy action. F-16 aircraft have flown more than 6,997,000 hours since the aircraft entered the Air Force inventory. Over that period, 293 Class A mishaps have occurred. This results in a Class A mishap rate of 4.19 per 100,000 flight-hours.

The Air Force regularly evaluates flight risks. Radar and integrated airspace scheduling minimize the potential for conflicting use of the airspace. Routes are regularly surveyed for manmade obstructions and those are plotted on aeronautical charts. The potential for bird-aircraft strikes are evaluated through a Bird Avoidance Model. The model indicates relative risk of strikes during various times of day and in different seasons of the year. Such information, along with specific route assessments prepared by the Air Force's Bird-Aircraft Strike Hazard (BASH) team, has proven highly successful in reducing incidence of strikes.

3.3 BIOLOGICAL RESOURCES

The term biological resources is used in this discussion to refer to plants and animals and the habitats in which they occur. Assemblages of plant and animal species within a defined area that are linked by ecological processes are referred to as natural communities. The existence and preservation of these resources are intrinsically valuable; they also provide aesthetic, recreational, and socioeconomic values to society. This section focuses on plant and animal species or vegetation types that typify or are important to the function of the ecosystem, are of special societal importance, or are protected under federal or state law or statute. For purposes of the analysis, biological resources will be organized into three major categories: (1) vegetation and habitat, including wetlands; (2) wildlife; and (3) special status species (defined below). A habitat-level perspective of the area proposed for LES-M use is applied for both descriptions of existing conditions and analyses of potential consequences in section 4.3.

Federal laws and regulations that apply to biological resources include: Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, Clean Water Act, National Environmental Policy Act (NEPA), Federal Land Policy and Management Act, Endangered Species Act (ESA), state hunting regulations, and state laws protecting plants and nongame wildlife.

The ROI for biological resources for the proposed action and alternatives consists of lands within Poinsett ECR and Dare County BECR and under the Bulldog and Gamecock MOAs.

Vegetation includes all existing terrestrial plant communities but excludes discussion of species with special protection status. The composition of plant species within a given area often defines ecological communities and determines the types of wildlife that may be present. *Wetlands* are considered special category sensitive habitats and are subject to regulatory authority under Section 404 of the Clean Water Act and Executive Order (EO) 11990, *Protection of Wetlands*. They include jurisdictional and non-jurisdictional wetlands. Jurisdictional wetlands are those defined by the United States Army Corps of Engineers (USACE) and United States Environmental Protection Agency as those areas that meet all the criteria defined in the USACE's *Wetlands Delineation Manual* (USACE 1987) and are under the jurisdiction of the USACE. Non-jurisdictional wetlands are those wetlands that fail to meet this requirement.

Wildlife includes all vertebrate animals with the exception of those with special protection status. Typical animals include terrestrial vertebrate species-groups such as snakes, lizards, songbirds, waterfowl, raptorial birds, hoofed animals, carnivores, rodents and other small mammals, and bats. Under particular circumstances, significant invertebrate species or species groups such as mollusks (e.g., snails) or insects may be included in discussions. The attributes and quality of available habitats determine the composition, diversity, and abundance patterns of wildlife species assemblages, or communities. Each species has its own set of habitat requirements and inter-specific interactions driving its observed distribution and abundance. Community structure is derived from the net effect of the diverse resource and habitat requirements of each species within a geographic setting. For this reason, an assessment of habitat types and the area affected by the proposed action can serve as an overriding determinant in the assessment of impacts for wildlife populations.

Special status species are defined as those plant and animal species listed as threatened, endangered, candidate or species of concern by the USFWS, as well as species with special state status. The ESA protects federally listed, threatened, and endangered plant and animal species. Candidate species are species that the USFWS is considering for listing as federal threatened or endangered but for which a proposed rule has not yet been developed. In this sense, candidates do not benefit from legal protection under the ESA. In some instances, candidate species may be emergency listed if the USFWS determines that the species population is at risk due to a potential or imminent impact. The USFWS encourages federal agencies to consider candidate species in their planning process as they may be listed in the future. Species of concern are species for which available information supports tracking of trends or threats. Similar definitions of threatened and endangered apply at the state level. Often state and federal lists have considerable overlap. State categories do not provide federal protection under the ESA but do provide a context for evaluating the sensitivity of habitats or communities.

3.3.1 Poinsett Electronic Combat Range and Restricted Area

Vegetation. Poinsett ECR lies within the Southeastern Mixed Forest Province described by Bailey (1995). In this region, local relief is low and the climate is characterized by mild winters and hot, humid summers.

Climax vegetation consists of mixed broadleaf and coniferous forests with at least 50 percent pine species. Important pine tree species include loblolly pine (*Pinus taeda*), longleaf pine (*Pinus palustris*), and shortleaf pine (*Pinus echinata*). Broadleaf trees found in drier sites within the mixed forest include several oak species such as southern red oak (*Quercus falcata*), black oak (*Quercus velutina*), white oak (*Quercus alba*), and post oak (*Quercus stellata*). Hickories (*Carya* spp.) are also widespread. Understory shrubs such as dogwood (*Cornus florida)* and redbud (*Cercis canadensis*) are abundant. In moister sites, maples (*Acer* spp.), sweetgum (*Liquidambar styraciflua*), and sycamore (*Platanus occidentalis*) are found. Communities in Carolina bays and shrub-dominated wetlands (pocosins) are often dominated by pond pine (*Pinus serotina*), honeycups (*Zenobia pulverulenta*), titi (*Cyrilla racemiflora*), loblolly bay (*Gordonia lasianthus*), and fetterbush (*Lyonia lucida*). Several species of sphagnum are also very common in pocosins and Carolina bays.

Although roads and powerlines bisect many areas of Poinsett ECR, particularly in the northern portion of the range, much of the forest habitat remains relatively undisturbed. Carolina bays and pocosin dominate the eastern portions of the range. Target areas and supporting facilities are concentrated in the northern half of the range and are characterized by land that has been cleared of forest, with grasses, nonnative forbs, and encroaching post oaks.

Wildlife. The variety of forest habitats found in the Southeastern Mixed Forest Province support a diverse wildlife community. Spanish moss (*Tillandsia usneoides*), which is associated with more than 160 species of arthropods (Air Force 2000b), provides food and nesting material for a variety of songbirds including ovenbirds (*Seiurus aurocapillus*), wood thrushes (*Hylocichla mustelina*), pine warblers (*Dendroica pinus*), summer tanagers (*Piranga rubra*), Carolina wrens (*Thrythorus ludovicianus*), and northern cardinals (*Cardinalis cardinalis*). The abundance of insects also supports a large number of amphibians such as eastern spadefoot toad (*Scaphiopus holbrookii*), southern toad (*Bufo terrestri*), and oak toad (*Bufo quercus*). Game birds in the region include eastern wild turkey (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*), and mourning dove (*Zenaida macroura*). Common mammals include Virginia opossum (*Didelphis marsupialis*), southern woodrat (*Neotoma floridana*), cotton mouse (*Peromyscus gossypinus*), gray squirrel (*Sciurus carolinensis*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and gray fox (*Urocyon cinereoargenteus*).

Special Status Species. The USFWS identified 10 special status species that may occur on or near Poinsett ECR based on occurrence records for Sumter County (Table 3.3-1; Appendix B). The red-cockaded woodpecker (*Picoides borealis*) is listed as endangered, while the bald eagle (*Haliaeetus leucocephalus*) is threatened. The American alligator (*Alligator mississippiensis*) is also listed as threatened, due to its similarity of appearance to a threatened taxon, the American crocodile (*Crocodylus acutus*). However, the American alligator itself is not biologically

threatened. The remaining seven species are species of concern, meaning they were previously considered for listing under the ESA. The state of South Carolina identified two additional species of concern (Table 3.3-1; Appendix C). Surveys are currently being conducted on Poinsett ECR to assess habitat composition and the presence or absence of several plant and animal species. Management plans for special status species, such as the red-cockaded woodpecker, and other biological resources are in development.

The red-cockaded woodpecker occurs on Poinsett ECR. They inhabit longleaf pines that are 70 to 100 years old. Most active breeding clusters are found in open pine stands rather than dense forest. The bald eagle does not occur within the ECR, while the alligator is found in swamps on the range.

3.3.2 Dare County Bombing and Electronic Combat Range and Restricted Areas

Restricted Areas R-5314 A, B, C, D, E, F, G, H, J are all associated with Dare County BECR, North Carolina. Dare County BECR is located within the Outer Coastal Plain Forest Province and is surrounded by the Alligator River, Albemarle Sound, Croatan Sound, and Pamlico Sound. Four major streams drain the Dare County Peninsula: Milltail Creek, Whipping Creek, Callaghan Creek and Long Shoal River. The range therefore supports a diversity of terrestrial and aquatic biological resources.

Vegetation. The dominant vegetation community at Dare County BECR is peatland, which is reflective of the permanently saturated, nutrient-deficient, low-pH soil conditions in the area. Pocosin communities and pond pine woodland are characteristic of North Carolina peatlands. Other vegetation communities include bay forest, nonriverine swamp forest, and Atlantic white cedar forest.

The dominant vegetation in pocosin communities is usually shrubs, including loblolly bay, inkberry (*Ilex galbra*), fetterbush, titi, and honeycups. The shrubs are often overgrown with greenbriar (*Smilax* spp.). Herbaceous vegetation includes Walter's sedge (*Carex striata*) and Virginia chainfern (*Woodwardia virginica*).

Bay forest, also called evergreen hardwood forest, is dominated by swamp red bay (*Persea borbonia*), loblolly bay, or sweet bay (*Magnolia virginiana*). Shrubs, grasses, and forbs are generally sparse because of the dense overstory.

Atlantic white cedar forests are typically even-aged stands with Atlantic white cedar (*Chamaecyparis thyoides*) as the dominant species. This forest type requires a very specific fire regime; a fire must remove competing vegetation, but if it burns too deeply into the peat the white cedars will be destroyed.

Wildlife. The Dare County BECR is surrounded on all sides by the Alligator National Wildlife Refuge (NWR). The Alligator NWR provides nesting and foraging habitat for 145 species of resident and migratory birds. Many of these species are shorebirds and waterfowl; because of their habitat preferences, these birds would be concentrated in the shoreline areas of the Dare

Table 3.3-1. State and Federally Listed Animal Species with Potential to Occur at the Poinsett ECR, Sumter County, South Carolina

Common Name	Scientific Name	Federal Status	State Status
Bird Species			
American kestrel	*Falco sparverius*	SC	SC
Bachman's sparrow	*Aimophila aestivalis*	SC	SC
Bald eagle	*Haliaeetus leucocephalus*	T	T
Henslow's sparrow	*Ammodramus henslowii*	SC	SC
Loggerhead shrike	*Lanius ludovicianus*	SC	SC
Painted bunting	*Passerina ciris*	SC	SC
Red-cockaded woodpecker	*Picoides borealis*	E	E
Mammal Species			
Black bear	*Ursus americanus*	---	SC
Reptile/Amphibian Species			
American alligator	*Alligator mississippiensis*	T(S/A)	T
Southern dusky salamander	*Desmognathus auriculatus*	SC	SC
Invertebrate Species			
Atlantic pigtoe mussel	*Fusconaia masoni*	---	T
Fish			
Broadtail madtom	*Noturus* sp 2	SC	SC

Status
E = Endangered.
T = Threatened.
SC = Species of concern.
T(S/A) = Threatened due to similarity of appearance

County Peninsula and not within the range. Many of the other bird species, however, may be found in the large tract of relatively undisturbed vegetation within the range.

Special Status Species. Table 3.3-2 lists plant and animal species with state or federal special status with potential to occur on Dare County BECR (Appendix C). These include four federally listed bird species: red-cockaded woodpecker, roseate tern (*Sterna dougallii*), bald eagle and piping plover (*Charadrius melodus*). A population of red wolves (*Canis rufus*) reintroduced into the adjacent Alligator NWR is considered an experimental population.

3.3.3 Military Operations Areas

Bulldog MOA is located in northeastern Georgia. Gamecock MOA lies in eastern South Carolina. Both of these areas are located within the Southeastern Mixed Forest Province (Bailey 1995) and consist of the southeastern evergreen forest association. Vegetation in both areas is similar to that described for Poinsett ECR.

Vegetation. Vegetation is dominated by the southern evergreen forest of the South Carolina Coastal Plain. Upland areas and sand ridges are typically forested with longleaf and loblolly pines, oaks, and hickory trees. Wax myrtle (*Morella cerifera*), holly (*Ilex* spp.), large gallberry (*Ilex coriacea*), and red bay are typical shrubs. Typical vines include greenbriar, grapes (*Vitus* spp.), and jessamine (*Jasminus* spp.). Bottomlands swamps along streams support trees such as cypress, sweetgum, tupelo gum (*Nyssa* spp.), and tulip tree (*Liriodendron tulipifera*).

Agriculture, including silviculture operations, is a significant component of the lands underlying the airspace and typically involves cleared land, large tracts of vegetative monoculture, and the introduction of large numbers of domestic livestock.

Wildlife. Potential wildlife communities include those described for Poinsett ECR. Rich in swamps, rivers, floodplain forests, pine forests, and pocosins, the coastal plains support a diverse and abundant assemblage of wildlife species.

The white-tailed deer, striped skunk (*Mephitis mephitis*), and a number of squirrel species are distributed throughout the ROI. Other common mammals include woodrats, various mouse species, and opossum. Black bear (*Ursus americanus*), bobcat (*Lynx rufus*), and gray fox inhabit wilder, more remote portions of the ROI.

Many species of birds are residents or follow the north-south trending ridges of the Appalachians or coastlines on their spring and fall migrations. Nesting birds in lowland forests include Carolina chickadees (*Poecile carolinensus*), tufted titmice (*Baeolophus bicolor*), red-eyed vireos (*Vireo olivaceus*), hooded warblers (*Wilsonia citrina*), and scarlet tanagers (*Piranga olivacea*). The concentration of migrants occurs mainly along the coast, although several species of raptors such as Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), and broad-winged hawk (*Buteo platypterus*) migrate along the ridges and valleys of the Appalachians. Swamp forests provide habitat for red-winged blackbirds (*Agelaius phoeniceus*), rails, various herons and egrets, and a variety of songbirds. Natural and manmade lakes provide wintering habitat for waterfowl such as the Canada goose (*Branta canadensis*), tundra

Table 3.3-2. State and Federally Listed Animal Species with Potential to Occur at the Dare County BECR, Dare County, North Carolina

Common Name	Scientific Name	Federal Status	State Status
Bird Species			
Anhinga	*Anhinga anhinga*	---	SR
Bald eagle	*Haliaeetus leucocephalus*	T	T
Black rail	*Laterallus jamaicensis*	SC	SR
Piping plover	*Charadrius melodus*	T	T
Red-cockaded woodpecker	*Picoides borealis*	E	E
Roseate tern	*Sterna dougallii*	E	E
Mammal Species			
Black bear	*Ursus americanus*	---	SR
"Buxton Woods" white-footed mouse	*Peromyscus leucopus* ssp. 1	SC	SR
Rafinesque's big-eared bat	*Plecotus rafinesquii*	SC	SR
Red wolf	*Canis rufus*	EX	E
Star-nosed mole	*Condylura cristata*	---	SC
Reptile/Amphibian Species			
American alligator	*Alligator mississippiensis*	T(S/A)	T
Invertebrate Species			
Aaron's skipper	*Poanes aaroni*	---	SR
Cane borer	*Acrapex relicta*	---	SR
Decorated spur-throat grasshopper	*Melanoplus decorus*	---	SR
Geometrid moth	*Metarranthis* sp.	---	SR
Hessel's hairstreak	*Callophrys hesseli*	---	SR
Inchworm moth	*Anacamptodes cypressaria*	---	SR
Inchworm moth	*Cepphis decoloraria*	---	SR
Inchworm moth	*Hypagyrtis NR brendae*	---	SR
Louisiana owlet moth	*Macrochilo louisiana*	---	SR
Owlet moth	*Dysgonia similis*	---	SR
Sundew cutworm moth	*Hemipachnobia monochromatea*	---	SR
Tussock moth	*Orgyia detrita*	---	SR
Watson's arugisa	*Arugisa watsoni*	---	SR

Status
C = Federal candidate species.
E = Endangered.
T = Threatened.
T(S/A) = Threatened due to similarity of appearance.
EX = Extinct in wild (population is introduced).
SC = Species of concern.
SR = Significantly rare.

swan *(Cygnus columbianus),* and ducks, and in summer are important feeding and nesting grounds for birds such as the osprey (*Pandion haliaetus*) and great blue heron (*Ardea herodias*).

Special Status Species. Based on lists provided by agencies and the habitats available within the restricted airspace, the primary protected species known or expected to occur within the airspace are the bald eagle, American peregrine falcon (*Falco peregrinus*), wood stork (*Mycteria americana*), red-cockaded woodpecker, piping plover, roseate tern, gray bat (*Myotis grisecens*), Virginia big-eared bat (*Plecotus townsendii virgianus*), Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*), and Indiana bat (*Myotis sodalis*). As presented in Appendix B, the USFWS (in a letter dated November 4, 2003) expressed specific concern regarding federally listed wood storks and eagles that nest and frequently travel in the Bulldog A and B MOA. The USFWS appended data on wood stork colonies and eagle nests and a map of wood stork foraging areas for three stork rookeries. Foraging areas cover most of the Bulldog MOA.

3.4 LAND USE

The attributes of land use focuses on general land use patterns, management plans, policies, ordinances, and regulations. Since a measurable change in the noise environment is not expected, nor a change in the existing range configuration, the land use analysis focuses primarily on specially designated land uses in the Poinsett ECR and Dare County BECR areas as well as under the MOAs. These designated land uses are managed with a specific intent or policy. These policies provide guidance on allowable uses for the land.

3.4.1 Poinsett Electronic Combat Range and Restricted Area R-6002

Poinsett ECR has been used by the Air Force since the early 1950's as a conventional bombing range. Located south of Shaw AFB in Sumter County, South Carolina, the range is approximately 12,500 acres in size and is comprised of a mixture of pine forests and wetland areas. Most of Poinsett ECR is flat, but there are some rolling sand hills typical of the Upper Coastal Plain physiographic province. The existing range has had limited commercial logging activity in the past and some recreational use, primarily for hunting. The existing range includes conventional and tactical target complexes with associated facilities and safety areas for training aircrews in delivering inert practice bombs, rockets, and strafing rounds.

Primary land uses surrounding the range and under R-6002 include agriculture and forestry. Special use areas in the vicinity of the base and under the airspace include a portion of the Manchester State Forest (including a Wildlife Management Area [WMA]), and Poinsett State Park.

Poinsett State Park is located in central South Carolina near Wedgefield, 18 miles southwest of Sumter. The park is located in an outlying area of the Sandhills, within the coastal plain. The park's terrain allows for diversity of plant and animal life. The facilities and activities include a campground, picnic shelters, nature center, hiking, equestrian and biking trails, fishing, swimming, and boating (South Carolina Department of Parks, Recreation, and Tourism n.d.).

Manchester State Forest, in Sumter and Clarendon Counties, consists of approximately 25,000 acres of mixed pine and hardwood species native to the midlands of South Carolina. The forest is managed to consider multiple uses including enhancing timber production, fish and wildlife habitat, air and water quality, soil conservation, scenic beauty, scientific research, and recreational opportunities. Manchester State Forest is included in the WMA Program through a cooperative agreement between the Department of Natural Resources and the South Carolina Forestry Commission (South Carolina Forestry Commission n.d.). Hunting and fishing with a permit/license are permitted.

In addition, the area around the Poinsett ECR is in a Conservation Preservation Zoning District. The intent of this district is to recognize, preserve, and protect environmentally sensitive areas of the county for future generations (Air Force 1994). Permitted uses in this district include most agricultural activities, parks and playgrounds, cemeteries, single-family, detached dwellings, and mobile homes (Air Force 1994).

3.4.2 Dare County Bombing and Electronic Combat Range and Restricted Area R-5314

The Navy and Air Force share use of the Dare County BECR and R-5314, located along the eastern coast of North Carolina, for air-to-surface target training. Dare County BECR encompasses 46,000 acres of marshland, forest and open space, and contains targets for inert weapons delivery practice. Dare County BECR was constructed on leased land in 1965. Exclusive Federal Jurisdiction was transferred to the Air Force in 1978. The joint Air Force/Navy range is utilized by 10 units. The largest users are Seymour Johnson AFB and Naval Air Station Oceana (Global Security 2003).

Since 1978, 41,200 acres of the range have been included in North Carolina Game Lands Program. The program allows public access to specific locations on the range. In addition, the Dare County Range Council Natural Resource Committee, consisting of military representatives, state wildlife officials and local hunters, oversees stewardship of the natural environment and recreation opportunities while balancing military training requirements (Global Security 2003).

Surrounding Dare County BECR and under R-5314 is the Alligator NWR. The refuge consists of over 152,000 acres of marshes and forestland. The refuge is open to public use year-round. Hunting is allowed on most of the refuge by permit only (North Carolina Out-Banks 2003).

3.4.3 Military Operations Areas

As depicted on Figure 1-2, MOA airspace associated with the proposed action includes the Gamecock and Bulldog MOAs. The A and B portions of the Bulldog MOA are located in the middle-eastern section of Georgia over portions of Burke, Jenkins, Bulloch, Emanual, Johnson, Washington, Glascock, and Jefferson counties. The primary land uses under the MOA include agriculture, forestry, and small rural towns. Magnolia Springs State Park is located under the MOA. The Fort Gordon Military Reservation is north of the MOA (Air Force 2002b). Other special land uses are listed on Table 3.4-1.

Table 3.4-1. Special Use Areas Under the MOAs

Name	Responsible Agency	MOA
Big Dukes Pond Preserve	The Nature Conservancy of Georgia	Bulldog
Dilane WMA	Georgia Department of Natural Resources	Bulldog
George L. Smith State Park	Georgia Department of Natural Resources	Bulldog
Magnolia Springs State Park	Georgia Department of Natural Resources	Bulldog
Ohoopee Dunes Natural Area	Georgia Department of Natural Resources	Bulldog
Piedmont National Wildlife Refuge	U.S. Fish & Wildlife Service	Bulldog
Savannah Coastal National Wildlife Refuge	U.S. Fish & Wildlife Service	Bulldog
Yuchi WMA	Georgia Department of Natural Resources	Bulldog
Frances Marion National Forest	U.S. Forest Service	Gamecock

Source: Air Force 2002b.

The B, C, and D portions of the Gamecock MOA are located in eastern South Carolina over portions of Williamsburg, Clarendon, Berkeley, Florence, Georgetown, and Marion counties. Agriculture, forestry, and small towns are the primary land uses under the MOA. The MOA is just outside the Santee NWR and Lake Marion (Air Force 2002b).

3.5 ENVIRONMENTAL JUSTICE

Socioeconomic resources are typically characterized in terms of population, housing, economic activity, community services, and infrastructure. The Proposed Action and alternatives do not include any direct changes in personnel levels or any construction activity or facility modifications. Consequently, there are no anticipated effects on the socioeconomic resources of the ROI. The analysis presented in this section will therefore be limited to a discussion of environmental justice and disadvantaged populations residing in the ROI, defined as those counties associated with Poinsett ECR and Dare County BECR and those underlying the airspace associated with Bulldog and Gamecock MOAs.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. The general purposes of this EO are as follows:

- To focus attention of federal agencies on the human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.
- To foster non-discrimination in federal programs that substantially affect human health or the environment.
- To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

EO 12898 applies to federal agencies that conduct activities that substantially affect human health or the environment. The concept of environmental justice therefore ensures that studies address the issue of determining if actions of federal agencies disproportionately impact the human health and environmental conditions in minority communities and low-income communities. The approach applied in this section is in accordance with the *Interim Guide for Environmental Justice with the Environmental Impact Analysis Process* (Air Force 1997b).

Also included with environmental justice issues are concerns pursuant to EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. This EO directs federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children. For purposes of this environmental justice analysis, minority, low-income and youth populations are defined as follows:

- *Minority Population*: Persons of Hispanic origin of any race, Blacks, American Indians, Eskimos, Aleuts, Asians, or Pacific Islanders.
- *Low-Income Population*: Persons living below the poverty level, estimated based on an average poverty threshold for a family of four in 2000 of $17,603 in annual income (United States Bureau of the Census 2000).
- *Youth Population*: Children under the age of 18 years.

Estimates of these three population categories were developed based on data from the United States Bureau of the Census. Total and minority population figures are based on recent demographic data released from Census 2000 (United States Bureau of the Census 2000). The census does not report minority population, per se, but reports population by race and by ethnic origin. These data were used to estimate minority populations potentially affected by implementation of the proposed action. Low-income population figures and youth population data are also derived from Census 2000 reports.

3.5.1 Poinsett Electronic Combat Range

Poinsett ECR is located in Sumter County, South Carolina, just south of Shaw AFB. The total 2000 population for Sumter County was 104,646 persons. Population density in Sumter County, home to the City of Sumter, is approximately 157.3 persons per square mile. By comparison, the State of South Carolina has an overall population density of 133.2 persons per square mile.

Minority persons account for 50.6 percent of Sumter County's population, compared to 33.9 percent of the South Carolina population. The county population is 16.5 percent low-income, compared with 14.1 percent for the state. The youth population, comprised of children under the age of 18 years, constitutes 28.1 percent of the county population, compared to 25.2 percent for South Carolina overall.

3.5.2 Dare County Bombing and Electronic Combat Range

Dare County BECR is located in Dare County, North Carolina, bordering the Atlantic Ocean in the northern part of the state. The total 2000 population for Dare County was 29,967 persons, just 0.4 percent of the North Carolina population of 8,049,313 persons. Population density in Dare County is approximately 78.1 persons per square mile. By comparison, the State of North Carolina has an overall population density of 165.2 persons per square mile.

Minority persons account for just 6.5 percent of Dare County's population, compared to 29.8 percent of the North Carolina population. The county population is 8.0 percent low-income, compared with 12.3 percent for the state. The youth population, comprised of children under the age of 18 years, constitutes 21.4 percent of the county population, compared to 24.4 percent for North Carolina overall.

3.5.3 Military Operations Areas

The MOAs addressed in this EA have been in existence for many years and the action being proposed would not alter the current configuration or use. MOAs are typically configured to avoid densely populated and metropolitan or urban areas therefore such airspace by design tends to be located over rural and less developed areas. While populated areas do occur within the boundaries of the airspace addressed in this EA, these areas are typically scattered, relatively low in density compared to urbanized areas and are avoided to the maximum extent possible.

Portions of counties in Georgia, North Carolina and South Carolina are located below the designated military airspace associated with Bulldog and Gamecock MOAs, as well as with Poinsett ECR and Dare County BECR. Table 3.5-1 identifies total population, percent minority population, percent low-income population and percent of children under 18 for each of these counties and for the three relevant states.

Bulldog MOA. Bulldog MOA overlies all or portions of the following nine counties in Georgia: Bulloch, Burke, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Richmond, and Washington. The total 2000 population for the Bulldog ROI was 357,971 persons, representing 4.4 percent of the 8,186,453 Georgia population. Population density in the Bulldog ROI ranged from 17.7 persons per square mile in Glascock County to 616.5 persons per square mile in Richmond County, home to the City of Augusta, which lies outside the actual Bulldog MOA boundary. By comparison, the State of Georgia has an overall population density of 141.4 persons per square mile. All counties in the Bulldog ROI, with the exception of Richmond County, have population densities well below the state average.

Table 3.5-1. Population and Environmental Justice Data by County (2000)

	Population	Minority	Low-Income	Youth	Density
Bulldog MOA					
Bulloch, Georgia	55,983	32.1	24.5	22.3	82.1
Burke, Georgia	22,243	53.5	28.7	31.3	26.8
Emanuel, Georgia	21,837	37.4	27.4	27.8	31.8
Glascock, Georgia	2,556	9.7	17.2	23.8	17.7
Jefferson, Georgia	17,266	58.2	23.0	28.4	32.7
Jenkins, Georgia	8,575	44.4	28.4	28.5	24.5
Johnson, Georgia	8,560	38.0	22.6	30.1	28.1
Richmond, Georgia	199,775	55.6	19.6	26.8	616.5
Washington, Georgia	21,176	54.6	22.9	26.9	31.1
State of Georgia	**8,186,453**	**37.4**	**13.0**	**26.5**	**141.4**
Gamecock MOA					
Clarendon, South Carolina	32,502	55.5	23.1	25.7	53.5
Florence, South Carolina	125,761	41.8	16.4	25.9	157.2
Georgetown, South Carolina	55,797	40.8	17.1	25.2	68.5
Horry, South Carolina	196,629	20.1	12.0	21.3	173.4
Marion, South Carolina	35,466	58.9	23.2	27.6	72.5
Williamsburg, South Carolina	37,217	67.5	27.9	28.6	39.9
State of South Carolina	**4,012,012**	**33.9**	**14.1**	**25.2**	**133.2**
Poinsett ECR					
Sumter, South Carolina	104,646	50.6	16.2	28.1	157.3
Dare County BECR					
Dare, North Carolina	29,967	6.5	8.0	21.4	78.1
State of North Carolina	**8,049,313**	**29.8**	**12.3**	**24.4**	**165.2**

Source: United States Bureau of the Census 2000.

Minority persons account for 49.7 percent of the Bulldog ROI population, compared to 37.4 percent of the Georgia population. The smallest percentage of minority residents in a single county is 9.7 percent (Glascock County) and the largest percentage is 58.2 percent (Jefferson County). Incidentally, Glascock County is also the least populated county with a total population of only 2,556 persons.

The population of the Bulldog ROI is 22.0 percent low-income, compared with 13.0 percent for the state of Georgia. The counties in the ROI are generally rural counties with low-income populations exceeding the overall state average. Low-income populations in the individual counties range from 17.2 percent (Glascock County) to 28.7 percent (Burke County).

The youth population, comprised of children under the age of 18 years, constitutes 26.8 percent of the Bulldog ROI population, compared to 26.5 percent for Georgia overall. There is relatively little variation in the youth population among the ROI counties, ranging from a low of 22.3 percent in Bulloch County to a high of 31.3 percent in Burke County.

Gamecock MOA. Gamecock MOA overlies all or portions of the following six counties in South Carolina: Clarendon, Florence, Georgetown, Horry, Marion and Williamsburg. The total 2000 population for the Gamecock ROI was 483,372 persons, representing 12.0 percent of the 4,012,012 South Carolina population. Population density in the Gamecock ROI ranged from 39.9 persons per square mile in Williamsburg County to 173.4 persons per square mile in Horry County--home to Myrtle Beach, which lies outside the actual Gamecock MOA boundary. By comparison, the State of South Carolina has an overall population density of 133.2 persons per square mile. All counties in the Gamecock ROI, with the exception of Horry and Florence counties, have population densities well below the state average.

Minority persons account for 37.0 percent of the Gamecock ROI population, compared to 33.9 percent of the South Carolina population. The smallest percentage of minority residents in a single county is 20.1 percent (Horry County) and the largest percentage is 67.5 percent (Williamsburg County).

The population of the Gamecock ROI is 16.5 percent low-income, compared with 14.1 percent for the state of South Carolina. With the exception of Horry County, all of the generally rural counties in the ROI have low-income populations exceeding the overall state average. Low-income populations in the individual counties range from 12.0 percent (Horry County) to 27.9 percent (Williamsburg County).

The youth population, comprised of children under the age of 18 years, constitutes 24.3 percent of the Gamecock ROI population, compared to 25.2 percent for South Carolina overall. There is relatively little variation in the youth population among the ROI counties, ranging from a low of 21.3 percent in Horry County to a high of 28.6 percent in Williamsburg County.

4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4.0 presents the environmental consequences of the proposed Mobile Laser Evaluator System (LES-M) employment for each of the resource areas discussed in Chapter 3.0. To define potential direct and indirect impacts, this chapter evaluates the project elements described in Chapter 2.0 against the affected environment provided in Chapter 3.0. Cumulative effects of the proposed action with other foreseeable future actions are presented in Chapter 5.0.

4.1 AIRSPACE AND RANGE MANAGEMENT

Potential effects of the alternative actions on the affected airspace environment were assessed by considering changes in aircraft operations and airspace uses that could occur relative to current conditions under each. If required, measures that could minimize potential impacts on air traffic and the Air Traffic Control (ATC) system were considered.

The type, size, shape, and configuration of individual airspace elements in a region are based upon, and are intended to satisfy, competing aviation requirements. Potential impacts could occur if air traffic in the region or the ATC systems were encumbered by changed flight activities associated with any of the alternative actions. When any significant change is planned, such as new or revised defense-related activities within an airspace area or a change in the complexity or density of aircraft movements, the Federal Aviation Administration (FAA) reassesses the airspace configuration to determine if such changes could adversely affect:

- ATC systems or facilities;
- Movement of other air traffic in the area; or
- Airspace already designated and used for other purposes supporting military, commercial, or civil aviation.

United States Air Force (Air Force) ranges are managed in accordance with requirements and procedures prescribed by Air Force Instruction (AFI) 13-212. These requirements address a wide range of considerations that include land ownership and control, weapons employment safety, range scheduling, range maintenance, Explosive Ordnance Disposal (EOD), range decontamination and debris disposal, and environmental stewardship of the range. Potential impacts could occur if some aspect of the alternative actions prevented, or significantly limited the ability of the range manager to comply with stipulated requirements.

4.1.1 Proposed Action

Under this alternative, F-16 aircraft assigned to the 20th Fighter Wing (20 FW) at Shaw Air Force Base (AFB) would be equipped with a more modern and technically advanced laser targeting system. Periodic deployment of an Advanced Targeting Pod (ATP) pod would significantly enhance the combat capability of the 20 FW. Coincident with the receipt of an ATP, an LES-M would be deployed to the Poinsett Electronic Combat Range (ECR). The LES-M is an important enhancement to aircrew training since it provides real-time feedback to the aircrew on the effectiveness of laser target designation.

The airspace used during actual aircrew training in the use of this pod would not change from current conditions. Pilots would continue to train in the same airspace with essentially the same level of use as under current conditions. Specific laser training using the new pod would occur on Poinsett ECR (R-6002), in the Bulldog A and B Military Operations Areas (MOAs), and the Gamecock B, C and D MOAs. No changes in use or configuration of the airspace comprising these areas are associated with this alternative. Therefore, no potential impacts to airspace management would be associated with the implementation of this alternative.

On Poinsett ECR, use of the ATP in conjunction with the LES-M would require firing the laser in tactical or combat mode. When fired in this mode, power output from the laser is significantly higher than when it is fired in the training or eye-safe mode (see Appendix D).

A prime range management responsibility is the requirement to ensure safe operation of the range. The basic safety requirement associated with laser use on a range is to prevent exposure of unprotected personnel to laser radiation in excess of Maximum Permissible Exposure levels which are defined by American National Standards Institute (ANSI) 7136.1-200. By estimating where laser energy would be at excessive levels on the ground, laser safety footprints can be developed. Footprints can be determined with the use of Laser Range Management Software (LRMS), developed by the Air Force Research Laboratory, and available at Air Force ranges. The Air Force Research Laboratory has conducted preliminary assessments of a prototype ATP (i.e., Sniper Extended Range [XR]) and documented guidelines pertaining to the safe operation of the system in both training and tactical mode. These data will be further refined when production models of the system are available (Roach 2002, Appendix D).

Prior to use of the ATP on Poinsett ECR, the Range Control Officer (RCO) would be required to ensure that all operational parameters of the ATP have been defined, and that those data were included in the LRMS and were used in developing laser safety footprints around applicable targets on the range. The RCO would then document these data in range operating supplements to AFI 13-212 for dissemination to all range users.

4.1.2 Alternative A

Under Alternative A, the LES-M would be sited on Dare County Bombing and Electronic Combat Range (BECR), which is supported by the restricted airspace R-5314. Aircrew from the 20 FW would continue to use existing airspace (Bulldog A and B MOAs and Gamecock B, C and D MOAs) for overall training, but, for specific training requiring use of the LES-M, fewer than 200 annual sortie-operations would be conducted on Dare County BECR. None of this training would require any modifications to, or reconfiguration of any of these airspace elements. Range activities are normally conducted by a flight of four aircraft. Using this as an estimate, training involving use of the LES-M would require an estimated 50 additional annual range periods at Dare County BECR (Appendix A). This is an average of less than one additional period per day, and would not be expected to exceed the capacity of Dare County BECR.

As previously discussed, range managers at Dare County BECR would be required to ensure that all safety evaluations concerning use of any ATP on the range had been conducted, and

that safe operating procedures for its use are documented in applicable range operating supplements to AFI 13-212.

Aircrew from the 20 FW would also train with the ATP in the Bulldog A and B and Gamecock B, C and D MOAs. However, use of the system would be limited to the eye-safe, or training mode, in these MOAs. Such training, and use of the system in training mode has no impact on the use or management of the Special Use Airspace (SUA) involved.

4.1.3 Alternative B: No Action Alternative

Alternative B is the No-Action Alternative. Under this alternative, aircraft at the 20 FW would be equipped with an updated laser targeting system, but the LES-M would not be procured or deployed to any training range. Aircrew from the 20 FW would continue to train in applicable military training airspace as under current conditions. Once production models of the ATP systems are available, applicable operational parameters would be provided to Air Force Research Laboratory staff for full laser-safety evaluations for any training in combat-mode on laser approved targets. In MOAs, laser use would be limited to eye-safe, or training mode, which would have no impact on airspace use or management. On ranges, no airspace modifications would be required, however, applicable operating safety data would be incorporated into range supplements to AFI 13-212.

4.2 SAFETY

Numerous federal, civil, and military laws and regulations govern operations at Shaw AFB. Individually and collectively they prescribe measures, processes, and procedures required to ensure safe operations and to protect the public, military, and property.

For each alternative action, the elements of the proposal that have a potential to affect safety are evaluated relative to the degree to which the action increases or decreases safety risks to aircrews, the public, and property. Ground, fire, and crash safety are assessed for the potential to increase risk, and the unit's capability to manage that risk by responding to emergencies and suppressing fire. In considering explosive safety, projected changes to use and handling requirements are compared to current uses and practices. If a unique situation is anticipated to develop as a result of any of the proposals, the capability to manage that situation is assessed. Analysis of flight risks correlates Class A mishap rates and bird-aircraft strike hazards with projected airspace utilization associated with the action. When compared to similar data for current use of the airspace, assessments can be made of the magnitude of the safety impacts resulting from the change. Since fire and crash risk are also a function of the risks associated with mishaps and bird-aircraft strikes, those statistical data are also considered in assessing that risk. Finally, when new or altered risks arising from the proposals are considered individually and collectively, assessments can be made about the adequacy of disaster response planning, and any additional or modified requirements that may be necessary as a result of the action.

4.2.1 Proposed Action

4.2.1.1 GROUND SAFETY

F-16CJ aircraft assigned to the 20 FW would be periodically configured with a new laser targeting system. This ATP system incorporates technological improvements that would enhance the air-to-ground laser targeting capability of the F-16 weapon system. Under the Proposed Action, coincident with installation of the ATP on the aircraft, an LES-M would be deployed to Poinsett ECR to support aircrew training with the new system. The LES-M provides real-time feedback to the aircrew on the effectiveness of the laser targeting.

Aircrew assigned to the 20 FW would train with the new ATP laser in existing training airspace currently used by the unit. Specifically, this includes the Bulldog A and B MOAs, the Gamecock B, C and D MOAs, and the restricted airspace R-6002 (Poinsett ECR). When used in the MOA airspace, power output of the laser would be limited to the training, or eye-safe mode. However, when used on Poinsett ECR the laser would be fired in tactical, or combat mode in order to receive feedback from the LES-M.

Hazards associated with laser use may include burning of the skin and ocular damage. In order to assess these risks, a preliminary hazard assessment of the Sniper XR, a candidate for the upgraded ATP laser, was conducted by the Air Force's Optical Radiation Branch of the Air Force Research Laboratory. Since a production model of the Sniper XR Pod was not available at the time of the assessment, the laser's design parameters provided by the manufacturers were used. The assessment was conducted in accordance with guidelines contained in Z136.1-2000 American National Standard for Safe Use of Lasers, as specified by Air Force Occupational Safety and Health Standard 48-139 (Roach 2002). The Sniper XR is a Class 4 laser in accordance with guidelines in ANSI Z136.1-2000 (Roach 2002). For the assessment, Nominal Ocular Hazard Distances (NOHDs) and required eye protection Optical Densities (ODs) were calculated for both unaided and aided (binocular) viewing. NOHD is defined as the distance from an operating laser at which the radiant exposure is equal to the maximum possible exposure. Distances beyond the NOHD are considered safe for accidental viewing. NOHDs based on the manufacturers design parameters associated with the system are shown in Table 4.2-1. Once a production model of the Sniper XR pod or the LITENING Advanced Targeting (AT) is available, the Air Force will complete a new hazard assessment to verify or establish the NOHDs.

Table 4.2-1. Nominal Ocular Hazard Distances for the Sniper XR Laser

Operating Mode	**NOHDS IN FEET**	
	Unaided	***Aided***
Tactical (combat) Mode	79,300	195,527
Training (eye-safe) Mode	0	3,707

Source: Roach 2002 (Appendix D).

A laser hazard zone is the airspace through which the laser beam is transmitted. It extends from the laser output aperture out to the NOHD, and personnel within this zone must wear laser eye protection. The laser surface danger zone is the ground area that intersects the laser hazard zone. When projected, or depicted on the ground, it portrays a laser hazard footprint. A computer program available to assist in calculating this footprint would be used by RCOs to develop and document safety requirements and procedures on ranges where the system could be used. This Laser Range Management Software is available at most Air Force ranges, including Poinsett ECR and Dare County BECR.

In most cases, the largest footprint is made by an aircraft using the longest slant range to the target being lased, and the lowest altitude flown during lasing. By varying these parameters, flight profile limitations can be developed for specific targets to ensure containment of the footprint within acceptable zones. In the preliminary assessment, calculations were performed that limited the ground-projected footprint to approximately 1,650 feet down-range of the target, 1,300 feet up-range from the target, and 65 feet on either side of the target. Applicable flight profile limitations are shown in Table 4.2-2.

Table 4.2-2. Flight Profile Constraints

Slant Range to Target (In Nautical Miles)	*Minimum Safe Lasing Altitude (In Feet AGL)*	*Slant Range to Target (In Nautical Miles)*	*Minimum Safe Lasing Altitude (In Feet AGL)*
12	16,187	6	4,138
11	13,629	5	2,899
10	11,292	4	1,879
9	9,174	3	1,081
8	7,275	2	501
7	5,597	1	141

Source: Roach 2002 (Appendix D).

In summary, based on the data available for the Sniper XR, there is an eye hazard on the combat range associated with this ATP laser when fired in tactical (combat) mode. In training (eye-safe) mode, there is no eye hazard when viewed unaided. However, a hazard does exist when the viewer is aided with an optical instrument (i.e., binoculars) and is looking directly at the laser from less than 3,707 feet. There is no skin hazard associated with this laser under any conditions.

As previously discussed, the system would be used in MOA airspace, but only in the training mode. Although calculations indicate that an eye hazard is associated with training mode if viewed "aided," the probability of such exposure is remote. When the land area underlying the training airspace is considered, the combined probability that a person would be present at the target being lased, that they would stare directly up the beam using binoculars, and that they

would be within 3,707 feet of the aircraft is so small that it may be essentially discounted. On Poinsett ECR, before the system would be approved for use, the RCO would perform all required safety evaluations and operational constraints to ensure safe operations are documented in range operating supplements to AFI 13-212 and disseminated to all aircrew using the range. Minimal ground safety risk is associated with the implementation of this alternative.

4.2.1.2 EXPLOSIVE SAFETY

The proposed training involving the LES-M and an ATP mounted on the aircraft would provide high quality training without the actual training ordnance. This enhanced training is not expected to result in any discernible change from current conditions in the unit's storage, maintenance, use, or disposition of ordnance. Therefore, implementation of the Proposed Action creates no specific explosive safety risks.

4.2.1.3 FLIGHT SAFETY

All 20 FW training would continue as under current conditions. Annual flying hours would remain essentially unchanged. Overall, use of military training airspace would also remain essentially unchanged. Use of an ATP in either the tactical or training mode creates no specific flight safety risks. Bird-Aircraft Strike Hazard (BASH) monitoring and evaluating will continue under current protocols. Therefore, flight risk remains as described in section 3.2.

4.2.2 Alternative A

Under Alternative A, the laser targeting capability of the F-16s assigned to the 20 FW would be upgraded with an ATP. To support aircrew training with this new system, an LES-M would be deployed to an air-to-ground training range. The only difference between the Proposed Action and this alternative is that the LES-M would be deployed to Dare County BECR, supported by the restricted airspace (R-5314).

Aircrew assigned to the 20 FW would train with the new ATP laser in existing training airspace. This includes the Bulldog A and B MOAs, the Gamecock B, C and D MOAs, and the restricted airspace R-5314 (Dare County BECR). When used in the MOA airspace, power output of the laser would be limited to the training, or eye-safe mode. However, when used on Dare County BECR the laser would be fired in tactical, or combat mode in order to interface with the LES-M.

Hazards associated with laser use may include burning of the skin and ocular damage. A preliminary hazard assessment of a candidate ATP, the Sniper XR laser, conducted by the Air Force's Optical Radiation Branch of the Air Force Research Laboratory in accordance with guidelines contained in Z136.1-2000 American National Standard for Safe Use of Lasers, showed that there is an eye hazard associated with the Sniper XR laser when fired in tactical (combat) mode. In training (eye-safe) mode, there is no eye hazard when viewed unaided. However, a hazard does exist if the viewer is aided with an optical instrument (i.e., binoculars). There is no skin hazard associated with the laser under any conditions. The system operating parameters used for this assessment were derived from data provided by the manufacturer.

Once the laser transitions into its production phase, actual components should be provided to the Air Force for verification of critical performance data and further analysis, if necessary.

As previously discussed, the system would be used in MOA airspace, but only in the training mode. Although calculations indicate that an eye hazard is associated with training mode if viewed "aided," the probability of such exposure is remote. When the land area underlying the training airspace is considered, the combined probability that a person would be present at the target being lased, and that they would stare directly up the beam using binoculars is so small that it may be essentially discounted. On Dare County BECR, before the system would be approved for use, the RCO would perform all required safety evaluations and operational constraints to ensure safe operations are documented in range operating supplements to AFI 13-212 and disseminated to all aircrew using the range. Minimal ground safety risk is associated with the implementation of this alternative.

All 20 FW training would continue as under current conditions. Annual flying hours would remain essentially unchanged. A slight change in sorties (fewer than 200 per year) within the military training airspace would occur due to placement of the LES-M at Dare County BECR. Use of an ATP in either the tactical or training mode creates no specific flight or explosive safety risks. Therefore, issues associated with flight and explosive safety remain as described in section 3.2.

4.2.3 Alternative B: No-Action Alternative

Alternative B is the No-Action Alternative. Under this alternative, aircraft at the 20 FW would be equipped with an updated laser targeting system, but the LES-M would not be procured or deployed to any training range. Aircrew from the 20 FW would continue to train in applicable military training airspace as under current conditions. Once production models of the ATP system are available, applicable operational parameters should be provided to Air Force Research Laboratory staff for full laser-safety evaluations. In MOAs, laser use would be limited to eye-safe, or training mode, which would have no impact on ground, flight, or explosive safety. On ranges, however, safety footprints for the use of the laser in tactical mode should be developed, and applicable operating safety data should be incorporated into range supplements to AFI 13-212.

4.3 BIOLOGICAL RESOURCES

This section analyzes the potential for impacts to biological resources from implementation of the Proposed Action and alternatives. Impacts potentially result from combat mode laser training using the LES-M on ranges or eye-safe laser training in the MOAs. No construction would be required for the proposed project under any alternative; therefore, no ground disturbance would occur. The Proposed Action or alternatives would not have a significant effect on plant communities, wetlands, or surface waters.

Determination of the significance of potential impact to biological resources is based on: 1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the

sensitivity of the resource to the proposed activities; and 4) the duration of potential disturbances. Impacts to biological resources are significant if species or habitats of high concern are adversely affected over relatively large areas, or if disturbances cause reductions in population size or distribution of a species of high concern.

4.3.1 Proposed Action

Flight operations by the 20 FW would not change from current conditions under the Proposed Action. Aircraft use of munitions and the noise levels associated with aircraft overflights would remain at current levels. Bird-strike risks are regularly evaluated by the BASH team. Therefore, there would be no significant impacts to biological resources resulting from flight operations under the Proposed Action.

In training (eye-safe) mode, laser fire from the pre-production version of the Sniper XR ATP does not present a hazard to humans in terms of ocular or skin damage (Roach 2002). As described in section 4.2, ocular hazards for humans increase if lasers are directly viewed through binoculars, telescopes, or other magnifying optics (i.e., "aided" hazards). Hazards for wildlife are considered similar to "unaided" hazards for humans. It is expected that injury to an animal could only occur if the animal were to gaze directly into the laser beam, an event that is unlikely. Low-powered lasers, similar in intensity to the ATP eye-safe mode, are currently being used as non-injurious and non-lethal methods to disperse problem wildlife such as cormorants and crow (APHIS 2002). However, case studies have typically used such lasers at night or dawn/dusk and at closer distances and longer durations than would be expected in Air Force training. Responses to laser were also species-specific and varied under different environmental conditions (Blackwell et al. 2002). Therefore, the chances that training could disturb and disperse wildlife are small. Combat laser training with the LES-M on the Poinsett ECR would involve a more intense laser beam. As discussed in section 4.2.1.1, all lasing would take place within a narrow, precisely calculated laser hazard footprint surrounding specific targets. Deployment of the LES-M would be on existing targets. While the areas surrounding the target areas on Poinsett ECR supports a diversity of wildlife species, the target areas are largely devoid of vegetation and the habitat is unsuitable for most species. Range personnel monitor target areas closely during all training activities and would delay target use if wildlife are detected on or near targets.

Due to the negligible hazard associated with training laser use, and the low probability that a higher intensity combat laser would be directly viewed by an animal within Poinsett ECR, there would be no projected significant impacts to biological resources under the Proposed Action.

In a letter dated November 4, 2003, the USFWS (West Georgia sub office and Coastal sub office) expressed concern regarding the potential effects of military training activities on the wood stork and bald eagle, which are both found under the Bulldog MOA. The wood stork, a federal endangered species, has breeding rookeries in this area and is known to forage throughout. The bald eagle also nests in the Bulldog MOA. Air Force operating procedures already specify avoidance of Lake Matamuskeet, Pungo Lake, and Swanquarter National Wildlife Refuges (NWR) by 2,000 feet above ground level (AGL) on Instrument Route (IR)-12, Carolina Sandhills

NWR by 2,000 feet AGL on Visual Route (VR)-87, Santee NWR by 2,200 feet AGL on VR-88 and VR-97, a wild life sanctuary by 1,500 feet AGL on VR-1059, and bald eagle nesting grounds by 3 nautical miles on VR-95 from September 1 to June 30 (see Figure 1-2). It is unlikely that the Proposed Action would have an adverse effect on these or other species because 1) avoidance areas have already been identified; 2) the Proposed Action does not involve any ground disturbance; 3) the Proposed Action does not include any changes to current aircraft operations; and 4) the ATP would only be used in eye-safe mode in this area. In letters dated April 7, 2004 and April 23, 2004, the USFWS (Charleston office, West Georgia sub office and Coastal sub office) concurred that the Proposed Action is not likely to adversely affect federally listed species (Appendix B).

4.3.2 Alternative A

For the purposes of the biological resources analysis, Alternative A is the same as the Proposed Action. Use of combat lasers with the LES-M would take place at Dare County BECR rather than at Poinsett ECR, although to a lesser extent. Fewer sorties by the 20 FW would occur in the local training area due to the diversion of some training to Dare County BECR. As with Alternative A, the potential for laser training to adversely affect wildlife or special status species in the MOAs would be negligible. The potential for combat laser consequences could potentially be higher, but the use of the LES-M on approved Dare County BECR targets typically do not represent quality habitat; therefore, the use of LES-M would not be expected to result in significant impacts. No impacts to biological resources are expected under Alternative A.

Under Alternative A, the selected ATP would be used in MOA airspace but only in the training mode. As presented in section 4.2.2, there is no eye hazard associated with the laser in this condition.

4.3.3 Alternative B: No-Action Alternative

Under Alternative B, aircraft operations would not change from existing conditions. Laser training with the LES-M would not occur; however, laser training within the airspace would still occur in eye-safe mode. Consequently, no impacts to biological resources would occur.

4.4 LAND USE

This section analyzes the impacts of the Proposed Action and alternatives on general land use patterns and land management. Impact analysis requires identification of management plans and use areas, followed by determination of potential effects due to proposed military operations.

4.4.1 Proposed Action

The Proposed Action would not require change to any land use at Poinsett ECR since no new construction or facility modification would occur. Military flight operations would also not change. Therefore no change in land use is expected.

Land use patterns or management practices would not be affected as military flight operations would not change and noise levels would remain the same. The proposed combat laser training with the LES-M at Poinsett ECR would be on existing targets and would be consistent with existing range land use. Within the Bulldog A and B MOAs and the Gamecock B, C and D MOAs, laser training would occur in the eye-safe mode. As described in section 4.2, safety concerns are negligible; therefore, land use consequences are not anticipated.

Implementation of the Proposed Action would have no significant impacts to land use or manpower, sortie-operations on the range, or land areas beneath the affected airspace.

4.4.2 Alternative A

Under this alternative, Dare County BECR would be used for combat laser training using the LES-M. As with the Proposed Action, no construction or facility changes or changes in military flight operations are required. Laser training would occur in MOA airspace as described under the Proposed Action. Therefore, no impacts to land use are expected.

4.4.3 Alternative B: No-Action Alternative

No impacts to land use are anticipated under the No-Action Alternative. Land use would remain as described for baseline conditions in section 3.4. All operations in the military training airspace would continue as under current conditions.

4.5 ENVIRONMENTAL JUSTICE

There are no anticipated manpower or facility changes as a result of the Proposed Action or alternatives evaluated in this environmental assessment (EA); consequently, no socioeconomic impacts are expected. Race, ethnicity, poverty status and age characteristics of populations in the relevant counties associated with affected airspace were analyzed. County figures were compared to regional and state demographics to assess potential environmental justice or potential disproportionate youth impacts and to determine proportional differences. Areas containing relatively high environmental justice-related populations were given special consideration regarding potential impacts in order to address the potential of disproportionately high or adverse human health or environmental effects on these communities. A review of the potential noise and safety effects of the proposed alternatives did not identify any disproportionate environmental justice impacts or risks to children.

4.5.1 Environmental Consequences

4.5.1.1 PROPOSED ACTION

Implementation of the Proposed Action would not create significantly adverse environmental or health effects on any populations living under the Bulldog A and B, Gamecock B, C and D MOAs or in the vicinity of Poinsett ECR. No disproportionately high or adverse human health or environmental effects on minority and low-income populations have been identified. In addition, there are no anticipated environmental health or safety risks associated with the Proposed Action that may disproportionately affect children.

4.5.1.2 ALTERNATIVE A

Implementation of Alternative A would not create significantly adverse environmental or health effects in or proximate to the Dare County BECR. No disproportionately high and adverse human health or environmental effects on minority and low-income populations and no anticipated environmental health or safety risks that may disproportionately affect children are associated with Alternative A.

4.5.1.3 ALTERNATIVE B: NO-ACTION ALTERNATIVE

Under the No-Action Alternative, activities in the affected land areas and airspace would remain unchanged from current conditions. Consequently, no environmental justice impacts or disproportionate risks to children would occur.

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5.0 CUMULATIVE EFFECTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.1 CUMULATIVE EFFECTS

This section provides 1) a definition of cumulative effects; 2) a description of past, present, and reasonably foreseeable actions relevant to cumulative effects; 3) an assessment of the nature of interaction of the Proposed Action and alternatives with other actions; and 4) an evaluation of cumulative effects potentially resulting from these interactions.

5.1.1 Definition of Cumulative Effects

Council on Environmental Quality (CEQ) regulations stipulate that the cumulative effects analysis within an Environmental Assessment (EA) should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 Code of Federal Regulations [CFR] 1508.7). Recent CEQ guidance in *Considering Cumulative Effects* affirms this requirement, stating that the first steps in assessing cumulative effects involve defining the scope of the other actions and their interrelationship with the proposed action and alternatives. The scope must consider geographic and temporal overlaps and must also evaluate the nature of interactions among these actions.

Cumulative effects are most likely to arise when a relationship or synergism exists between a proposed action and alternatives and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the proposed action would be expected to have more potential for a relationship than actions that may be geographically separated. Similarly, actions that coincide, even partially, in time would tend to offer a higher potential for cumulative effects.

To identify cumulative effects, this EA analysis addresses three questions:

1. Does a relationship exist such that elements of the Proposed Action might interact with elements of past, present, or reasonably foreseeable actions?
2. If one or more of the elements of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action?
3. If such a relationship exists, does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

In this EA, an effort has been made to identify all actions that are being considered and that are in the planning phase at this time. To the extent that details regarding such actions exist and the actions have a potential to interact with the Proposed Action in this EA, these actions are

included in this cumulative analysis. This approach enables decisionmakers to have the most current information available so that they can evaluate the environmental consequences of the Proposed Action.

5.1.2 Past, Present and Reasonably Foreseeable Actions

This EA applies a stepped approach to provide decisionmakers with not only the cumulative effects of the Proposed Action but also the incremental contribution of past, present, and reasonably foreseeable actions.

5.1.2.1 PAST ACTIONS RELEVANT TO THE PROPOSED ACTION AND ALTERNATIVES

Shaw Air Force Base (AFB) is an active military installation that undergoes continuous change in mission and in training requirements. This process of change is consistent with the United States Defense policy that forces must be ready to respond to threats to American interests throughout the world. In the past eight years, two force structure changes have occurred at Shaw AFB. In 1996, the number of A/OA-10s was reduced from 39 to 18 Primary Aircraft Inventory (PAI) aircraft. The United States Air Force (Air Force) also increased the number of F-16s at Shaw AFB from 54 to 78 PAI Block 50 aircraft by the end of August 1996. Sortie-operations in the Poinsett Electronic Combat Range (ECR), two Military Operations Areas (MOAs), and one Military Training Routes (MTR) did not noticeably change as a result of the 1996 actions. Sortie-operations in two Warning Areas, three MOAs, and 24 MTRs increased slightly. Base personnel increased by 97 from 5,892 to 5,989 persons as a result of these 1996 actions.

By 2002 Shaw AFB was home to four squadrons of F-16 Block 50 aircraft - three 18 Primary Mission Aircraft Inventory (PMAI) squadrons and one 24 PMAI squadron. In fiscal year (FY) 03 the Air Force deactivated the 78th Fighter Squadron and added 12 newer F-16 Block 50 aircraft to be distributed among other squadrons within the 20th Fighter Wing (20 FW). The 20 FW has the 55th, 77th, and 79th Fighter Squadrons and each squadron now has 24 PMAI Block 50 F-16 aircraft. Base personnel are 5,663 after this force structure change.

Also in 2002 the base received approval from the Federal Aviation Administration (FAA) for changes to utilization of several existing airspace units under the management of the 20 FW. The action, environmentally assessed in 2001, included adjustments in the altitude of three MTRs and extension of the operating hours for six MOAs. The three MTRs were Visual Routes (VRs)-087, -088, and -1060, which overlie counties in South Carolina, North Carolina, and Virginia (depicted in Figure 1-2). The proposal also increased the ceilings of each MTR to 6,500 feet above ground level (AGL). The six MOAs involved in the extension of operating hours included the Gamecock B, C, and D MOAs and the Bulldog A and B MOAs. The proposal extended the operating hours from 10:30 PM to midnight in Gamecock B, C and D MOAs and both Bulldog MOAs.

In FY 03 a temporary training mission was established at Shaw AFB. To support this mission approximately 8,400 square feet of trailer space and 5,000 square feet of maintenance area, along

with 22 personnel were added to the base. This action was analyzed and categorically excluded in 2002.

The base has also completed construction of new buildings to house the 28th Weather Squadron and a new dining facility. EAs for the force structure change and this construction were completed and Findings of No Significant Impact (FONSIs) were issued.

In 1994, Poinsett ECR, which was established in 1951, was expanded to include the construction of a new tactical target complex and television ordnance scoring system. Management of the range's natural resources has been defined in the Integrated Natural Resources Management Plan (INRMP) FY 2001-2005, including threatened and endangered species management, forest management, and wildland fire management.

Dare County Bombing and Electronic Combat Range (BECR), established in 1965, has maintained its 46,621 acres in accordance with the guidelines identified in its INRMP (1999) and the Fire Management Plan adopted in 2002.

5.1.2.2 PRESENT ACTIONS RELEVANT TO THE PROPOSED ACTION AND ALTERNATIVES

Shaw AFB, like any other major institution, also requires occasional new construction, facility improvements, and infrastructure upgrades. Shaw AFB plans on completing in 2004 a 31,920 square foot Education Center. Two of the three Aircraft Maintenance Units (AMUs) are planned for completion by 2004 to provide space for administration, supervision, and training of personnel and storage of tools and supplies to support day-to-day flightline maintenance of fighter aircraft. The third AMU would be constructed after completion of the first two and demolition of the existing structures. This project includes the demolition of five older facilities totaling 41,000 square feet. The new AMUs would total 36,000 square feet. EAs for these actions were completed in 2002 and FONSIs were issued.

Poinsett ECR continues to implement its INRMP and the associated Operational Component Plans, particularly the Forestry Management Plan and red-cockaded woodpecker recovery efforts.

Shaw AFB recently concluded an EA for the use of chaff and flares as defensive countermeasures for training in Bulldog A and B MOAs and Bulldog B Air Traffic Control Assigned Airspace (ATCAA), and Gamecock B, C and D MOAs and Gamecock D ATCAA (Air Force 2003). Three F-16 squadrons from Shaw AFB's 20 FW and one squadron from McEntire Air National Guard's 169th Fighter Wing would continue to use these airspace units for training and would add the use of chaff and flares.

5.1.2.3 REASONABLY FORESEEABLE ACTIONS THAT INTERACT WITH THE PROPOSED ACTION AND ALTERNATIVES

This category of actions includes Air Force actions that have a potential to coincide, either partially in time or geographic extent, with the Proposed Action or the alternatives. Information on these actions is included to determine whether these actions would, if

implemented, incrementally affect environmental resources. These recently proposed actions include:

- Shaw AFB proposes to privatize on-base military family housing. This would involve conveying 1,702 housing units to a private contractor. The contractor would conduct renovation, demolition, and construction, over a seven-year period, resulting in a total of 1,447 military housing units. Demolition and construction would be conducted in phases in order to keep as many units as possible filled during the project. An Environmental Baseline Survey (EBS) and an EA were completed in 2003 and a FONSI signed in February 2003. The award of the program is projected to occur by March 2004.
- Shaw AFB is currently considering construction of an extension to their wastewater discharge pipe to the Wateree River. This action would require a pumping station and approximately five miles of additional pipeline. Environmental analysis for this project is underway.
- Construction of a new Readiness Complex has been recently proposed and an environmental analysis is scheduled for completion by April 2004. Two structures (6,720 square foot Mobility Storage Warehouse and 4,775 square foot Disaster Preparedness Facility) and a 170 foot by 1,000 foot Airfield Pavement Training Facility would be constructed starting in the third quarter of FY 04. Environmental analysis for this complex is underway.
- Shaw AFB is being considered as a site for the establishment of a permanent air sovereignty mission. If chosen for this mission, permanent alert facilities would be constructed to support this mission. Once a decision is made, an environmental analysis of the action has been initiated.
- Dare County BECR is currently proposing to implement its Fire Management Plan and Prescribed Burn Program and to construct a Simulated Runway Complex, Expended Ordnance Storage Area and Target Pad Expansions. An environmental analysis of these two actions is currently underway.

5.1.3 Analysis of Cumulative Effects

The following analysis examines how the impacts of the actions presented above might be affected by those resulting from the Proposed Action and alternatives at Shaw AFB, Poinsett ECR and Dare County BECR and whether such a relationship would result in potentially significant impacts not identified when the Proposed Action or alternatives are considered individually.

This analysis also considers the cumulative effects of the Proposed Action, Alternative A and Alternative B, the No-Action Alternative. Alternative A would result in minor changes to sortie operations to accommodate placement of the Mobile Laser Evaluator System (LES-M) at Dare County BECR. Alternative B, the No-Action Alternative, represents status quo conditions and would not represent any change from the existing environment.

No specific projects have been identified that would produce incremental impacts when added to other past, present, or reasonably feasible future actions. Shaw AFB, Poinsett ECR, and Dare County BECR are active military installations that undergo changes in mission and in training requirements in response to defense policies, current threats, and tactical and technological advances. These facilities, like any other major institution (e.g., university, industrial complex), require new construction, facility improvements, infrastructure upgrades, and maintenance and repairs. All of these factors (i.e., mission changes, facility improvements, and tenant use) would continue to occur before, during, and after the Proposed Action if it is selected.

The base and range actions described in section 5.1.2 affect very specific areas and, for the most part, the scope of the actions is focused**.** None of these actions would be expected to result in more than negligible impacts individually or cumulatively. The LES-M proposed use in training would not be anticipated to result in cumulative effects on Shaw AFB or Poinsett ECR under either the Proposed Action or Alternative B. There is no construction required for LES-M deployment so there would be no cumulative consequences with the ongoing or planned construction projects described above. Personnel training in the use of the LES-M would not affect personnel numbers and the mobile deployment of the LES-M is anticipated to use existing Poinsett ECR vehicles.

The 2001 change in airspace utilization that was evaluated in a separate EA identified no significant impacts. When the airspace action is considered in conjunction with the proposed LES-M deployment, no significant impacts are anticipated. The use of defensive chaff and flares was recently analyzed for potential environmental effects. There are no direct, indirect, or cumulative effects of using chaff and flares in defensive training within the MOAs in conjunction with, or independent from, training with an ATP and the LES-M on either Poinsett ECR or Dare County BECR.

The cumulative effects of the proposed employment of an LES-M and these future actions would remain below the threshold of significance for airspace use and any other resource area.

5.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The National Environmental Policy Act (NEPA) requires that environmental analysis include identification of "...any irreversible and irretrievable commitments of resources; which would be involved in the proposed action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resource and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

For the Proposed Action, most resource commitments are neither irreversible nor irretrievable. Those limited resources that may involve a possible irreversible or irretrievable commitment under the Proposed Action are discussed below.

Training operations would continue and involve consumption of nonrenewable resources, such as gasoline used in vehicles, and jet fuel used in aircraft. None of these activities would be expected to significantly decrease the availability of minerals or petroleum resources.

Mobile vehicle use for the LES-M and personal vehicle use by personnel continuing to support the existing missions would consume fuel, oil, and lubricants. The consumption of these materials is not expected to significantly affect the availability of the resources.

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APPENDIX A
SORTIE TABLE

Table A-1. Annual Sortie-Operations in 20th FW Managed/Utilized Airspace

Airspace Unit	Current Use		Proposed Action and No-Action Alternative		Change in Use	Alternative A – Use of Dare County BCER		Change in Use
	All Aircraft Day/Night	F-16 Contribution Day/Night	All Aircraft Day/Night	F-16 Contribution Day/Night		All Aircraft Day/Night	F-16 Contribution Day/Night	
IR-002	111/0	60/0	111/0	60/0	0	111/0	60/0	0
IR-012	224/0	18/0	224/0	18/0	0	224/0	18/0	0
IR-074	67/0	17/0	67/0	17/0	0	67/0	17/0	0
IR-089	58/0	22/0	58/0	22/0	0	58/0	22/0	0
IR-090	41/0	4/0	41/0	4/0	0	41/0	4/0	0
IR-721/VR-1721	264/0	52/0	264/0	52/0	0	264/0	52/0	0
IR-726/VR-1726	170/0	52/0	170/0	52/0	0	170/0	52/0	0
IR-743/VR-1743	131/0	45/0	131/0	45/0	0	131/0	45/0	0
VR-058	232/0	118/0	232/0	118/0	0	232/0	118/0	0
VR-085	1420/0	297/0	1420/0	297/0	0	1420/0	297/0	0
VR-086	90/0	30/0	90/0	30/0	0	90/0	30/0	0
VR-087	1098/11	533/5	1098/11	533/5	0	1098/11	533/5	0
VR-088	900/9	645/6	900/9	645/6	0	900/9	645/6	0
VR-092	196/0	128/0	196/0	128/0	0	196/0	128/0	0
VR-093	182/0	67/0	182/0	67/0	0	182/0	67/0	0
VR-094	212/0	116/0	212/0	116/0	0	212/0	116/0	0
VR-095	400/0	231/0	400/0	231/0	0	400/0	231/0	0
VR-096	406/0	9/0	406/0	9/0	0	406/0	9/0	0
VR-097	676/0	172/0	676/0	172/0	0	676/0	172/0	0
VR-1059	1342/30	688/0	1342/30	688/0	0	1342/30	688/0	0
VR-1060	716/7	59/1	716/7	59/1	0	716/7	59/1	0
VR-1061	182/10	19/0	182/10	19/0	0	182/10	19/0	0
W-161	3528/39	1966/0	3528/39	1966/0	0	3528/39	1966/0	0
W-177	3949/255	2344/55	3949/255	2344/55	0	3949/255	2344/55	0
Bulldog A/B	6581/77	5523/66	6581/77	5523/66	0	6581/77	5523/66	0
Gamecock B	0/0	0/0	0/0	0/0	0	0/0	0/0	0
Gamecock C	4194/42	780/8	4194/42	780/8	0	4194/42	780/8	0
Gamecock D	4561/47	3350/35	4561/47	3350/35	0	4561/47	3350/35	0
Gamecock I	2221/22	102/1	2221/22	102/1	0	2221/22	102/1	0
R-6002	4737/155	3287/66	4737/155	3287/66	0	4617/155	3117/66	-170
R-5314[1]	9053/377	945/37	9053/377	945/37	0	9223/377	1115/39	+170

Note: 1. Sortie operations for R-5314 were derived from a review of the past 7 years of use (FY 96-02) to reflect the level of use without overseas deployments.

APPENDIX B
PUBLIC AND AGENCY COORDINATION

Distribution List for EA

Distribution List for EA

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Congresswoman Elizabeth Dole, 120 Russell Senate Office Building, Washington, DC 20510

Congressman John Edwards, 225 Dirksen Senate Office Building, Washington, DC 20510

Congressman Lindsey Graham, 290 Russell Senate Office Building, Washington, DC 20510

Congressman Ernest Hollings, 125 Russell Senate Office Building, Washington, DC 20510

Congressman Zell Miller, 257 Dirksen Senate Office Building, Washington, DC 20510

Sample Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) Letters

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE VIRGINIA

MEMORANDUM FOR: Phil Degarmo
U.S. Fish and Wildlife Service Ecological Field Office
176 Croghan Spur Road, Suite 200
Charleston SC 29407-7558

FROM: HQ ACC/CEVP
129 Andrews St., Suite 102
Langley AFB VA 23665-2969

SUBJECT: Employment of a Mobile Laser Evaluator System (LES-M)

1. The United States Air Force is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts of employing a mobile laser evaluator system (LES-M) (Attachment 1) to support laser training by the 20th Fighter Wing (FW) of Shaw Air Force Base SC. The LES-M supports laser training by providing immediate feedback to F-16 aircrews regarding the accuracy of their targeting systems. All laser operations outside restricted airspace and range boundaries would be performed in the training (eye-safe) mode. Training would occur during normal sorties and no new airspace would be developed.

2. The Air Force is considering the following alternative locations for the deployment of the LES-M. Attachment 2 depicts the proposed project areas:

- Alternative A: Poinsett Electronic Combat Range. Deploy the LES-M to Poinsett Range located in Sumter County near Shaw AFB, SC. Aircraft equipped for training purposes would use the Bulldog A/B and Gamecock B/C/D MOAs.
- Alternative B: Dare County Range. Deploy the LES-M to Dare County Range in eastern North Carolina. A LES-M would be placed at that range and aircrews would train under the same conditions as outlined in Alternative A.

3. In association with the analysis and in compliance with the Endangered Species Act, we are requesting information regarding federally listed threatened, endangered, candidate, and proposed to be listed species that occur or may occur in counties within the potentially affected area (Attachment 3). Please provide your response or any other specific concerns by 6 Oct 03 to the EA Project Manager, Ms. Brenda Cook, at the above address or at (757) 764-9339. We anticipate a draft EA will be made available for public and agency review in late 2003. Thank you for your assistance.

GILBERT N. BURNET, P.E.
Chief, Environmental Analysis Branch

Attachments:
1. LES-M Fact Sheet
2. Location Map
3. List of counties within the potentially affected area

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE VIRGINIA

MEMORANDUM FOR: South Carolina State Historic Preservation Office
8301 Parkland Road
Columbia SC 29223-4905

FROM: HQ ACC/CEVP
129 Andrews St., Suite 102
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SUBJECT: Employment of a Mobile Laser Evaluator System (LES-M)

1. The United States Air Force is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts of employing a mobile laser evaluator system (LES-M) (Attachment 1) to support laser training by the 20th Fighter Wing (FW) of Shaw Air Force Base SC. The LES-M contributes to laser training by providing feedback to F-16 crews regarding the accuracy of their targeting systems. All laser operations outside restricted airspace and range boundaries would be performed in the training (eye-safe) mode. Training would occur during normal sorties and no new airspace would be developed.

2. The Air Force is considering the following alternative locations for the deployment of the LES-M. Attachment 2 depicts the proposed project areas:

- Alternative A: Poinsett Electronic Combat Range. Deploy the LES-M to Poinsett Range located in Sumter County near Shaw AFB, SC. Aircraft equipped for training purposes would use the Bulldog A/B and Gamecock B/C/D MOAs.
- Alternative B: Dare County Range. Deploy the LES-M to Dare County Range in eastern North Carolina. A LES-M would be placed at that range and aircrews would train under the same conditions as outlined in Alternative A.

3. We anticipate no impacts to cultural resources with the use of either of the above alternatives; however, we will provide you a copy of the draft EA for review in late 2003. If you have any specific concerns contact the EA Project Manager, Ms. Brenda Cook by 6 Oct 03. She can be reached at the above address or at (757) 764-9339. Thank you for your assistance.

GILBERT N. BURNET, P.E.
Chief, Environmental Analysis Branch

Attachments:
1. LES-M Fact Sheet
2. Location Map

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE VIRGINIA

MEMORANDUM FOR: U.S. Fish and Wildlife Service
P.O. Box 33726
Raleigh NC 27636-3726

FROM: HQ ACC/CEVP
129 Andrews St., Suite 102
Langley AFB VA 23665-2969

SUBJECT: Employment of a Mobile Laser Evaluator System (LES-M)

1. The United States Air Force is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts of employing a mobile laser evaluator system (LES-M) (Attachment 1) to support laser training by the 20th Fighter Wing (FW) of Shaw Air Force Base SC. The LES-M supports laser training by providing immediate feedback to F-16 aircrews regarding the accuracy of their targeting systems. All laser operations outside restricted airspace and range boundaries would be performed in the training (eye-safe) mode. Training would occur during normal sorties and no new airspace would be developed.

2. The Air Force is considering the following alternative locations for the deployment of the LES-M. Attachment 2 depicts the proposed project areas:

- Alternative A: Poinsett Electronic Combat Range. Deploy the LES-M to Poinsett Range located in Sumter County near Shaw AFB, SC. Aircraft equipped for training purposes would use the Bulldog A/B and Gamecock B/C/D MOAs.
- Alternative B: Dare County Range. Deploy the LES-M to Dare County Range in eastern North Carolina. A LES-M would be placed at that range and aircrews would train under the same conditions as outlined in Alternative A.

3. In association with the analysis and in compliance with the Endangered Species Act, we are requesting information regarding federally listed threatened, endangered, candidate, and proposed to be listed species that occur or may occur in counties within the potentially affected area (Attachment 3). Please provide your response or any other specific concerns by 6 Oct 03 to the EA Project Manager, Ms. Brenda Cook, at the above address or at (757) 764-9339. We anticipate a draft EA will be made available for public and agency review in late 2003. Thank you for your assistance.

GILBERT N. BURNET, P.E.
Chief, Environmental Analysis Branch

Attachments:
1. LES-M Fact Sheet
2. Location Map
3. List of counties within the potentially affected area

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE VIRGINIA

MEMORANDUM FOR: South Carolina Department of Natural Resources, Ft. Johnson Office
P.O. Box 12559
Charleston SC 29422-2559

FROM: HQ ACC/CEVP
129 Andrews St., Suite 102
Langley AFB VA 23665-2969

SUBJECT: Employment of a Mobile Laser Evaluator System (LES-M)

1. The United States Air Force is in the process of preparing an Environmental Assessment (EA) to assess the potential environmental impacts of employing a mobile laser evaluator system (LES-M) (Attachment 1) to support laser training by the 20th Fighter Wing (FW) of Shaw Air Force Base SC. Specifically, the Air Force would deploy one LES-M to an established military training range. The LES-M supports laser training by providing immediate feedback to F-16 aircrews regarding the accuracy of their targeting systems. All laser operations outside range boundaries and restricted airspace would be conducted in the training or eye-safe mode. The purpose of this action is to train aircrews in the employment of precision-guided munitions in all weather conditions and to maintain mission readiness for worldwide deployment in support of Air Expeditionary Forces. Laser training operations would occur during normal training sorties and would be accomplished within the existing airspace utilized by Shaw AFB, SC. No new airspace would be developed.

2. The Air Force is considering the following alternative locations for the deployment of the LES-M. Attachment 2 depicts the proposed project areas:

- Alternative A: Poinsett Electronic Combat Range. Deploy the LES-M to Poinsett Range located in Sumter County near Shaw AFB, SC. Aircraft equipped for training purposes would use the Bulldog A/B and Gamecock B/C/D MOAs.
- Alternative B: Dare County Range. Deploy the LES-M to Dare County Range in eastern North Carolina. A LES-M would be placed at that range and aircrews would train under the same conditions as outlined in Alternative A.

The EA will evaluate the potential environmental impacts from these two alternatives in addition to evaluating a no-action alternative that would not establish a LES-M to support 20th FW training.

3. As part of the environmental analysis, the Air Force or its contractors may contact you during data collection efforts. In advance, we thank you for your assistance in this activity. If you have any specific information or questions relative to this EA, we would like to hear from you. Please contact the EA Project Manager, Ms. Brenda Cook, at the above address or at (757) 764-9339. We anticipate a draft EA will be made available for public and agency comment in late 2003.

GILBERT N. BURNET, P.E.
Chief, Environmental Analysis Branch

Attachments:
1. LES-M Fact Sheet
2. Location Map

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE VIRGINIA

MEMORANDUM FOR: Mr. Gilbert Blue, Chairman
Catawba Indian Tribe
P.O. Box 188
Catawba SC 29704

FROM: HQ ACC/CEVP
129 Andrews St., Suite 102
Langley AFB VA 23665-2969

SUBJECT: Employment of a Mobile Laser Evaluator System (LES-M)

1. The United States Air Force is in the process of preparing an Environmental Assessment (EA) to assess the potential environmental impacts of employing a mobile laser evaluator system (LES-M) (Attachment 1) to support laser training by the 20th Fighter Wing (FW) of Shaw Air Force Base SC. Specifically, the Air Force would deploy one LES-M to an established military training range. The LES-M supports laser training by providing immediate feedback to F-16 aircrews regarding the accuracy of their targeting systems. All laser operations outside range boundaries and restricted airspace would be conducted in the training or eye-safe mode. The purpose of this action is to train aircrews in the employment of precision-guided munitions in all weather conditions and to maintain mission readiness for worldwide deployment in support of Air Expeditionary Forces. Laser training operations would occur during normal training sorties and would be accomplished within the existing airspace utilized by Shaw AFB, SC. No new airspace would be developed.

2. The Air Force is considering the following alternative locations for the deployment of the LES-M. Attachment 2 depicts the proposed project areas:

- Alternative A: Poinsett Electronic Combat Range. Deploy the LES-M to Poinsett Range located in Sumter County near Shaw AFB, SC. Aircraft equipped for training purposes would use the Bulldog A/B and Gamecock B/C/D MOAs.
- Alternative B: Dare County Range. Deploy the LES-M to Dare County Range in eastern North Carolina. A LES-M would be placed at that range and aircrews would train under the same conditions as outlined in Alternative A.

The EA will evaluate the potential environmental impacts from these two alternatives in addition to evaluating a no-action alternative that would not establish a LES-M to support 20th FW training.

3. As part of the environmental analysis, the Air Force or its contractors may contact you during data collection efforts. In advance, we thank you for your assistance in this activity. If you have any specific information or questions relative to this EA, we would like to hear from you. Please contact the EA Project Manager, Ms. Brenda Cook, at the above address or at (757) 764-9339. We anticipate a draft EA will be made available for public and agency comment in late 2003.

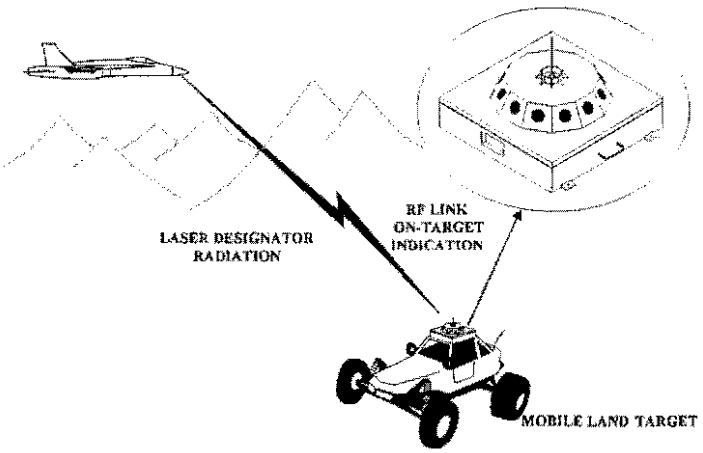
GILBERT N. BURNET, P.E.
Chief, Environmental Analysis Branch

Attachments:
1. LES-M Fact Sheet
2. Location Map

LASER EVALUATOR SYSTEM-MOBILE MX-11485/U

TRAINING FOR AIRBORNE LASER DESIGNATION

* **PORTABLE**
* **360 DEGREE COVERAGE**
* **REAL-TIME FEEDBACK**
* **SIMPLE INSTALLATION**

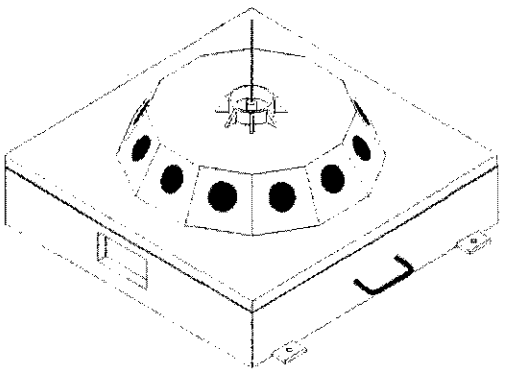


The Laser Evaluator System - Mobile (LES-M) is designed to provide training support for airborne laser designators. This portable system provides real-time, closed-loop training by transmitting a tone on an RF carrier whenever it is effectively illuminated by a laser designator. This RF signal is transmitted on a pre-assigned frequency, and may be monitored by the designator operator and training authorities for evaluation.

The LES-M may be installed on any target authorized for laser use. It has a 360 degree field of view, allowing simple installation and realistic training. Set-up involves placing the system at the desired target aim point, assembling the antenna, and connecting power. Where power is available, this procedure requires approximately three minutes. Typical targets include ships, boats, barges, nearby land targets and, when available, QLT-1C mobile targets.

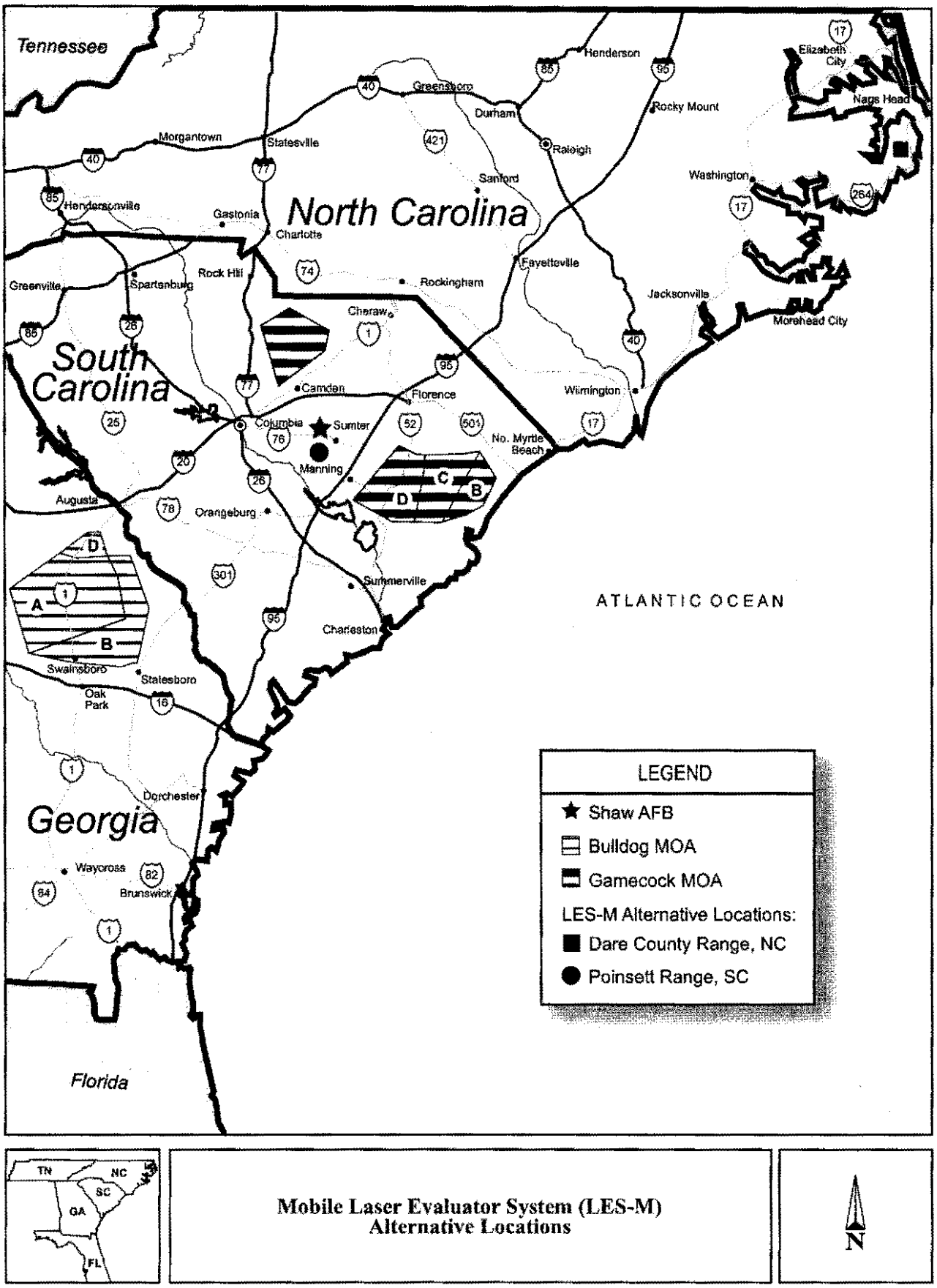
SPECIFICATIONS

WAVE LENGTH	1.064 MICROMETERS
SENSITIVITY	0.4 MICROJOULE PER SQ. CM.
FIELD OF VIEW	360 DEGREES AZIMUTH
TRANSMITTER	2.0 W RF OUTPUT MINIMUM 225 TO 400 MHZ SINGLE CHANNEL
ANTENNA	VERTICAL POLARIZATION 1/4 WAVELENGTH GROUND PLANE
POWER	105-130 VAC, 22-32 VDC, 150 WATT MAXIMUM
SIZE	24" L X 24" W X 14" H
WEIGHT	70 POUNDS
TEMPERATURE	-25 TO +80 DEGREES CELSIUS
VIBRATION	15 TO 55 HZ @ 0.025 EXCURSION
SHOCK	22 G'S FOR 11 MS
MOISTURE	SEALED TO DIRECT RAIN
SYSTEM MTBF	GREATER THAN 960 HOURS
SUPPORT	BUILT-IN-TESTS AND INTERFACE SOFTWARE



Naval Air Warfare Center Weapons Division
Laser and Surveillance Systems Group
Point Mugu, California, 93042-5001
DSN 351-8504, Commercial (805) 989-8504

27 October 1997


Tennessee
North Carolina
South Carolina
Georgia
Florida
ATLANTIC OCEAN
Henderson
Greensboro
Durham
Rocky Mount
Elizabeth City
Nags Head
Morgantown
Statesville
Raleigh
Washington
Sanford
Hendersonville
Gastonia
Charlotte
Fayetteville
Greenville
Spartanburg
Rock Hill
Rockingham
Jacksonville
Morehead City
Cheraw
Camden
Florence
Wilmington
Columbia
Sumter
No. Myrtle Beach
Manning
Augusta
Orangeburg
Summerville
Charleston
Swainsboro
Statesboro
Oak Park
Dorchester
Wayoross
Brunswick
A
B
C
D
LEGEND
Shaw AFB
Bulldog MOA
Gamecock MOA
LES-M Alternative Locations:
Dare County Range, NC
Poinsett Range, SC
TN
NC
SC
GA
FL
Mobile Laser Evaluator System (LES-M)
Alternative Locations
N

Counties Potentially Affected by Employing a Mobile Laser Evaluator System (LES-M) to Support Laser Training by the 20th Fighter Wing of Shaw Air Force Base, South Carolina.

Georgia

Burke
Jenkins
Bulloch
Emanuel
Johnson
Washington
Glascock
Jefferson
Richmond

North Carolina

Dare County

South Carolina

Sumter County

IICEP Response Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

October 8, 2003

Mr. Gilbert N. Burnet, P.E.
HQ ACC/CEVP
129 Andrews Street, Suite 102
Langley AFB VA 23665-2969

Dear Mr. Burnet:

Thank you for your letter requesting information from the U.S. Fish and Wildlife Service (Service) regarding the preparation of an Environmental Assessment (EA) to evaluate the impacts of employing a mobile laser evaluator system (LES-M) to support laser training by the 20th Fighter Wing of Shaw Air Force Base, located in Sumter County, South Carolina. Your letter was received in the Service's Raleigh Field Office on September 11, 2003. Our comments are provided in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e), and the Endangered Species Act of 1973, as amended (16 U.S. 1531-1543) (Act).

A current list of federally-protected species and their habitat requirements which may occur within the general project area within the State of North Carolina can be found on our website, http://nc-es.fws.gov/es/countyfr.html. Based on the information contained in your letter, project effects should be considered on the federally listed red-cockaded woodpecker (*Picoides borealis*; RCW), bald eagle (*Haliaeetus leucocephalus*), American alligator (*Alligator mississippiensis*), and red wolf (*Canis rufus*) in evaluating Alternative B.

The Service is interested in the conservation of wildlife resources, including avian species particularly in and near National Wildlife Refuge lands. For this reason, we would like to remain informed as to the employment of any systems or devices that might create a conflict with our agency's mandates to conserve migratory birds or affect the Service's ability to use aerial survey for censusing of trust wildlife species.

If you have any questions regarding this matter, please contact me at 919-856-4520 (Ext. 28). Thank you for your continued cooperation with our agency.

Sincerely,

John S. Hammond
Endangered Species Coordinator

cc: Mike Bryant, USFWS
Bud Fazio, USFWS

North Carolina Department of Cultural Resources
State Historic Preservation Office
David L. S. Brook, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary
Office of Archives and History

Division of Historical Resources

October 16, 2003

Gilbert N. Burnet, Chief
Environmental Analysis Branch
Department of the Air Force
HQ ACC/CEVP
129 Andrews St., Suite 102
Langley AFB VA 23665-2969

Re: Employment of a Mobile Laser Evaluator System, Dare County, ER03-2480

Dear Mr Burnet:

Thank you for your letter of September 11, 2003, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,
Renee Gledhill-Earley
David Brook

North Carolina
Department of Administration

Michael F. Easley, Governor

Gwynn T. Swinson, Secretary

September 12, 2003

Ms. Brenda Cook
Department of the Air Force
HQ ACC/CEVP
129 Andrews St - Suite 102
Langley AFB VA 23665

Dear Ms. Cook:

Subject: Scoping - USAF proposes to assess the potential environmental impact of employing a mobile laser evaluator system (LES-M), to support training by the 20th FW of Shaw Air Force Base SC.

The N. C. State Clearinghouse has received the above project for intergovernmental review. This project has been assigned State Application Number 04-E-0000-0066. Please use this number with all inquiries or correspondence with this office.

Review of this project should be completed on or before 10/12/2003 . Should you have any questions, please call (919)807-2425.

Sincerely,

Chrys Baggett

Ms. Chrys Baggett
Environmental Policy Act Coordinator

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail: Chrys.Baggett@ncmail.net

Location Address:
116 West Jones Street
Raleigh, North Carolina

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
247 South Milledge Avenue
Athens, Georgia 30605

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

November 4, 2003

Mr. Gilbert N. Burnet, P.E.
Chief, Environmental Analysis Branch
Department of the Air Force
Headquarters Air Combat Command
Langley Air Force Base, Virginia 23665-2969
ATTN: Ms. Brenda Cook, EA Project Manager

Re: FWS Log No. 03-0653

Dear Mr. Burnet:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter which we received September 11, 2003 regarding the employment of a Mobile Laser Evaluator System (LES-M) to support laser training by the 20th Fighter Wing of Shaw Air Force Base SC. The LES-M supports laser training by providing immediate feedback to F-16 aircrews regarding the accuracy of their targeting systems. All laser operations would be performed in the training (eye-safe) mode. Training would occur during normal sorties and no new airspace would be developed.

In your letter, you requested information on potential impacts to federally listed species that could occur in Georgia in Bulloch, Burke, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Richmond, and Washington Counties. We have enclosed these county lists, which can be found at our website: athens.fws.gov.

Because of the high speed jet aircraft which may be flying at low altitudes, we are particularly concerned about federally listed wood storks and eagles that nest and frequently travel in the Bulldog A/B Military Operations Area (MOA). We have enclosed the 2003 data we have on the wood stork colonies and eagle nests that occur in this area. We have also enclosed a map of the wood stork foraging areas for three wood stork rookeries and these foraging areas cover most of the Bulldog MOA.

Wood storks are large long-legged wading birds about 33 - 44 inches in height with a wingspan of 59 - 65 inches and weigh 5 - 8 pounds. In Georgia, breeding usually begins in March with

incubation taking 27 - 32 days. Young storks begin learning to fly at about eight weeks of age. However, the young often remain at the colony and return to the nest to be fed by adults until around 12 weeks of age. Wood storks use a variety of feeding sites in both freshwater and estuarine wetlands to obtain adequate forage and fly long distances to feed and obtain food for the young..

Wood storks typically fly more like soaring hawks and vultures than like other birds, which flap their wings constantly. Although they can and do use standard flapping flight for short trips, they prefer to soar in convective currents or thermals, circling in these rising pockets of warm air to reach altitudes of 1000 - 3000 feet before gliding to their destination or the next thermal. By soaring, storks can travel as far as 30 - 40 miles to reach a feeding site with low energy cost to the birds. Storks often roost in habitat similar to where they nest, such as in trees surrounded by water. However, it is also common to find flocks of storks "resting"on mud flats and ground near feeding sites. These sites are probably "day roosts", where the storks are waiting before starting to feed depending on changing water levels or the activity of their prey. Many species of fish are more active and "catchable" at different times of the day.

Beginning in late summer, wood storks gather into communal roosts along the coast and may move out of the Bulldog MOA. According to the "Habitat Management Guidelines for the Wood Stork in the Southeast Region", there should not be any aircraft operation closer than 500 feet of a nesting colony. However, the safety of the pilots and aircraft should be considered with these large birds frequenting the Bulldog MOA from March to the late summer or early fall.

Bald eagles are 30 - 43 inches and have a wingspan of 72 - 98 inches and weigh from 8 - 12 pounds. Bald eagles almost always nest near open water, usually in a large open-topped pine, often on high ground if available. Eagles form permanent pair bonds and use a nest year after year. In Georgia, courtship and nest-building typically occur in October and November. Two to three eggs are then laid in December or January and are incubated for about 35 days. The eaglets fledge at about two weeks, typically in late March or April, but they remain under parental care for several more weeks. Adults bald eagles from Georgia are essentially non-migratory, but they might wander away from the nesting area until the next nesting season. Bald eagles from the northern United States will migrate down to Georgia in the winter. The nesting season is the most critical time for bald eagles and this occurs in the winter.

According to the "Habitat Management Guidelines for the Bald Eagle in the Southeast Region", the Primary Zone is the most critical area for nesting eagles. Fixed wing aircraft operation within 500 feet vertical distance or 1000 feet horizontal distance from a nest would likely be detrimental while eagles are present and, therefore, should be restricted in the Primary Zone during the nesting period, but not necessarily during the non-nesting period.

The Secondary Zone for bald eagles is from the Primary Zone to one mile. Low level aircraft operations should only take place in this zone during the non-nesting period.

This covers the two most obvious federally listed species that could be affected by these training flights. However, the nine county lists should be used to determine if there is habitat that could be used by any of the other federally listed species in carrying out these training missions.

We appreciate the opportunity to comment on these training exercises which could occur in the Bulldog MOA. We are the point of contact for training activities in the Bulldog MOA. However, we would appreciate receiving courtesy copies of the correspondence to our Charleston Ecological Services office regarding the Gamecock MOA. If you have any questions or require further information, please contact staff biologist Kathy Chapman at 912-265-9336 ext.24 or email kathy_chapman@fws.gov.

Sincerely,

Robert Brooks

for Sandra S. Tucker
Field Supervisor

Enclosures

cc:
FWS, Athens, Georgia
FWS, Charleston, SC (Phil DeGarmo)

Listed Species in Bulloch County (updated July 2002)				
Species	Federal Status	State Status	Habitat	Threats
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. An active eagle nest was located in Bulloch County in 2002	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Plant				
Georgia plume *Elliottia racemosa*	No Federal Status	T	Sand ridges, dry oak ridges, evergreen hammocks, and sandstone outcrops in a variety of sandy soil conditions ranging from moist to very dry	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods	
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, sandhill seeps, Atlantic white-cedar swamps, wet savannahs, low areas in pine flatwoods, and along sloughs and ditches	

Listed Species in Burke County (updated June 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Last breeding record for Burke County was in the 1940's.	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearclutting, mechanical site preparation), fire suppresion and residential and commercial development.
Invertebrate				
Atlantic pigtoe mussel *Fusconaia masoni*	No Federal Status	E	Found in unpolluted, fast-flowing water in coarse sand/gravel substrate.	
Fish				
Shortnose sturgeon[1] *Acipenser brevirostrum*	E	E	Atlantic seaboard rivers	Construction of dams and pollution, habitat alterations from discharges, dredging or disposal of material into rivers, and related development activities.
Plant				
Canby's dropwort *Oxypolis canbyi*	E	E	Peaty muck of shallow cypress ponds, wet pine savannahs, and adjacent sloughs and drainage ditches	Loss or alteration of wetland habitats
Georgia plume *Elliottia racemosa*	No Federal Status	T	Sand ridges, dry oak ridges, evergreen hammocks, and sandstone outcrops in a variety of sandy soil conditions ranging from moist to very dry	
Indian olive *Nestronia umbellula*	No Federal Status	T	Dry open upland forests of mixed hardwood and pine	
Ocmulgee skullcap *Scutellaria ocmulgee*	No Federal Status	T	Forested terraces, hardwood slopes and riverbanks of tributaries to the Ocmulgee, Oconee, and Savannah Rivers	
Rosemary *Ceratiola ericoides*	No Federal Status	T	Driest, openly vegetated, scrub oak sandhills and river dunes with deep white sands of the Kershaw soil series	
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, sandhill seeps, Atlantic white-cedar swamps, wet savannahs, low areas in pine flatwoods, and along sloughs and ditches	

Listed Species in Emanuel County (updated June 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Last breeding record for Emanuel County was in the 1940s.	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearclutting, mechanical site preparation), fire suppresion and residential and commercial development.
Plant				
Dwarf witch-alder *Fothergilla gardenii*	No Federal Status	T	Low, flat, swampy areas, especially shrub-dominated margins of upland swamps (pocosins), Carolina bays, pitcherplant bogs, wet savannahs, and Atlantic white-cedar swamps	
Georgia plume *Elliottia racemosa*	No Federal Status	T	Sand ridges, dry oak ridges, evergreen hammocks, and sandstone outcrops in a variety of sandy soil conditions ranging from moist to very dry	
Indian olive *Nestronia umbellula*	No Federal Status	T	Dry open upland forests of mixed hardwood and pine	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods	
Pickering's morning-glory *Stylisma pickeringii*	No Federal Status	T	Coarse white sands on sandhills near the Fall Line and on a few ancient dunes along the Flint and Ohoopee Rivers	
Rosemary *Ceratiola ericoides*	No Federal Status	T	Driest, openly vegetated, scrub oak sandhills and river dunes with deep white sands of the Kershaw soil series	
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, sandhill seeps, Atlantic white-cedar swamps, wet savannahs, low areas in pine flatwoods, and along sloughs and ditches	

Listed Species in Glascock County (updated June 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.

Listed Species in Jefferson County (updated July 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia. An active bald eagle nest was located in Jefferson County in 1999 and 2002.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Amphibian				
Flatwoods salamander *Ambystoma cingulatum*	T	T	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis. Found in Jefferson County October 1997	Habitat destruction as a result of agricultural an silvicultural practices (e.g., clearcutting, mechanical site preparation), fire suppresion and residential and commercial development.
Invertebrate				
Atlantic pigtoe mussel *Fusconaia masoni*	No Federal Status	E	Found in unpolluted, fast-flowing water in coarse sand/gravel substrate.	
Plant				
Indian olive *Nestronia umbellula*	No Federal Status	T	Dry open upland forests of mixed hardwood and pine	
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, sandhill seeps, Atlantic white-cedar swamps, wet savannahs, low areas in pine flatwoods, and along sloughs and ditches	

Listed Species in Jenkins County (updated January 2003)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps. Active rookeries were located in Jenkins County 1991-2002.	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Eastern indigo snake *Drymarchon corais couperi*	T	T	During winter, den in xeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Invertebrate				
Atlantic pigtoe mussel *Fusconaia masoni*	No Federal Status	E	Found in unpolluted, fast-flowing water in coarse sand/gravel substrate.	
Plant				
Canby's dropwort *Oxypolis canbyi*	E	E	Peaty muck of shallow cypress ponds, wet pine savannahs, and adjacent sloughs and drainage ditches	Loss or alteration of wetland habitats

Listed Species in Johnson County (updated June 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Fish				
Robust redhorse *Moxostoma robustum*	No Federal Status	E	Medium to large rivers with shallow to deep flowing moderately swift water.	

Listed Species in Richmond County (updated July 2003)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Wood stork *Mycteria americana*	E	E	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Reptile				
Gopher tortoise *Gopherus polyphemus*	No Federal Status	T	Well-drained, sandy soils in forest and grassy areas; associated with pine overstory, open understory with grass and forb groundcover, and sunny areas for nesting	Habitat loss and conversion to closed canopy forests. Other threats include mortality on highways and the collection of tortoises for pets.
Invertebrate				
Atlantic pigtoe mussel *Fusconaia masoni*	No Federal Status	E		
Plant				
Dwarf witch-alder *Fothergilla gardenii*	No Federal Status	T	Low, flat, swampy areas, especially shrub-dominated margins of upland swamps (pocosins), Carolina bays, pitcherplant bogs, wet savannahs, and Atlantic white-cedar swamps	
Georgia plume *Elliottia racemosa*	No Federal Status	T	Sand ridges, dry oak ridges, evergreen hammocks, and sandstone outcrops in a variety of sandy soil conditions ranging from moist to very dry	
Indian olive *Nestronia umbellula*	No Federal Status	T	Dry open upland forests of mixed hardwood and pine	
Ocmulgee skullcap *Scutellaria ocmulgee*	No Federal Status	T	Forested terraces, hardwood slopes and riverbanks of tributaries to the Ocmulgee, Oconee, and Savannah Rivers	
Parrot pitcher-plant *Sarracenia psittacina*	No Federal Status	T	Acid soils of open bogs, wet savannahs, and low areas in pine flatwoods; a reported population in Richmond County may have been misidentified	
Pickering's morning-glory *Stylisma pickeringii*	No Federal Status	T	Coarse white sands on sandhills near the Fall Line and on a few ancient dunes along the Flint and Ohoopee Rivers	
Rosemary *Ceratiola ericoides*	No Federal Status	T	Driest, openly vegetated, scrub oak sandhills and river dunes with deep white sands of the Kershaw soil series	
Shoals spider-lily *Hymenocallis coronaria*	No Federal Status	E	Major streams and rivers in rocky shoals and in cracks of exposed bedrock; plants can be completely submerged during flooding	
Sweet pitcher-plant *Sarracenia rubra*	No Federal Status	E	Acid soils of open bogs, sandhill seeps, Atlantic white-cedar swamps, wet savannahs, low areas in pine flatwoods, and along sloughs and ditches	

[1]This species is the responsibility of the National Marine Fisheries Service.

Listed Species in Washington County (updated June 2002)				
Species	**Federal Status**	**State Status**	**Habitat**	**Threats**
Bird				
Bald eagle *Haliaeetus leucocephalus*	T	E	Inland waterways and estuarine areas in Georgia.	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Red-cockaded woodpecker *Picoides borealis*	E	E	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh	Reduction of older age pine stands and encroachment of hardwood midstory in older age pine stands due to fire suppression
Fish				
Robust redhorse *Moxostoma robustum*	No Federal Status	E	Medium to large rivers with shallow to deep flowing moderately swift water.	
Plant				
Bay star-vine *Schisandra glabra*	No Federal Status	T	Twining on subcanopy and understory trees/shrubs in rich alluvial woods	
Harper dodder *Cuscuta harperi*	No Federal Status	T	Parasite usually found on rayless-goldenrod (*Chondrophora virgata*); rarely parasitic on other herbs found on granite or sandstone outcrops	

Wood Storks

The generally accepted explanation for the decline of the wood stork as a U.S. breeding species is the reduction in the food base (primarily small fish) necessary to support breeding colonies. This reduction is attributed to loss of wetland habitat as well as to changes in hydroperiods.(excerpt from Recovery Plan).

Wood storks feed, to a large extent, on small, freshwater fish, which usually range in length between 2.0 and 25 cm. Because of the stork's specialized grope-feeding technique for capturing fish works most efficiently where fish densities are high, much foraging occurs at sites where fish have become concentrated by dropping water levels. Characteristically, good feeding sites are those with still or very slow flowing water at depths of between about 5 and 30 cm. Since storks locate fish primarily by feel rather than by sight, good foraging sites can be either clear or muddy, or may contain appreciable amounts of submerged or emergent vegetation. The only important constraint with vegetation is that it not be so dense as to interfere with a stork's movements as it makes repeated probes into the water with its bill.

Many wetland sites may provide suitable foraging areas, including drying roadside ditches, isolated tidal pools exposed by dropping tides, drying depressions in marshes or wooded swamps, edges of farm ponds, edges or shallows in streams during low water periods, natural wet grasslands, or seasonal ponds in pastures. Suitable feeding sites are not known to have specific requirements in terms of water quality or site location, so long as the basic water depth, water stillness and fish density are appropriate. Some foraging sites may only be seasonally flooded, and most are only suitable to foraging storks during periods of the year when fish are concentrated. Thus, falling water levels may be essential at many locations as a mechanism to concentrate fish. Conversely, during periods of heavy rainfall, or whenever levels are rising, fish densities in many pools may not be high enough to attract storks.

Most stork nesting colonies are located in regions with relatively large numbers of wetland sites within a 40 mile radius of the colony. Storks utilize many different feeding sites during the course of a nesting season and to nest successfully, they may be required to nest in regions where the number of feeding site options are high. The smaller feeding sites may be cleaned out by a number of storks in only a day, requiring that these birds locate a new feeding site the next day. It is also important that there be enough diversity in wetland habitats within range of a colony so that the proper water depths and fish densities are available at several sites at any time during the 4 to 5 month nesting cycle. In some regions, this requirement is met through a complex mosaic of many small pools, sloughs, ditches, and secondary creeks woven throughout a flat or low-rolling landscape. In the Everglades and Big Cypress regions of south Florida, uneven drying rates caused by subtle differences in marsh depth and the presence of deeper "gator holes" and sloughs, provide a prolonged period of suitable feeding conditions for storks. During early winter in Florida, when water levels are still too deep in interior marshes, storks feed almost exclusively in more coastal mangrove swamps and tidal pools. As the winter dry season progresses, storks gradually move further and further inland, essentially following the drying edge, and concentrating their feeding effort in many isolated pools where fish are trapped by the dry-down. Such a condition apparently once provided the ideal feeding habitat capable of supporting large number of wood storks and why there were large nesting colonies in southern Florida.

TABLE 1: KNOWN WADING BIRD COLONIES SURVEYED FOR WOOD STORKS BY AIRCRAFT IN 2003

20	RTOC - Mission Forest	Camden		[redacted]		Location Questionable, did not survey
21	Cravens Hammock*	Charlton	21-z		6-May-03	Water but no birds
22	Little Buffalo Creek*	Charlton	23-z		6-May-03	GREG, other waders
23	Gum Slough	Charlton	22-z		6-May-03	water but no birds, drop from list in 04
24	St. Marys River	Charlton				Did not survey
25	Ossabaw Egret Pond	Chatham	13		5-May-03	no nesting but plenty of water
26	Ossabaw Middle Place	Chatham	12		5-May-03	GREG, SNEG, TCHE, BCNH, 20 loafing WOST
27	Ossabaw Hog Pond*	Chatham	14		5-May-03	water but no birds nesting
28	Ossabaw	Chatham	11		5-May-03	some water
29	Little Tybee Beach Hammock	Chatham	16		5-May-03	5 GREG
30	Wassaw	Chatham	15		5-May-03	water but no birds nesting
31	Savannah Yacht Club	Chatham	19		5-May-03	85 GREG, 20 GTBH
32	Burnt Pot Island	Chatham	18		5-May-03	GREG, GTBH
33	Skidaway Island Landings*	Chatham	17		5-May-03	**45 WOST**, GREG, SNEG, 6 DCCO, BCNH
34	Burroughs	Chatham	23		5-May-03	no birds
35	Blue Pond	Crisp/Wilcox				Did not survey
36	Lukes Pond?**	Colquit				did not survey
37	Cypress Lake	Dodge			11-May-03	Audubon IBA day syrvey, no WOST, 5,000 pr waders
38	Martin Branch	Echols	19-z			skipped, in Moody Airspace
39	Durden's Pond	Emanuel	22		5-May-03	water and birds nesting, GREG, SNEG, ANHI, GTBH, Tortoises near site

[redacted]

[1]Data provided by Larry Bryan, Savannah River Ecology Lab
[2]Data provided by John Robinette, USFWS
*Historical or present wood stork rookery site
**New Wading Bird Location

TABLE 1: KNOWN WADING BIRD COLONIES SURVEYED FOR WOOD STORKS BY AIRCRAFT IN 2003

40	St. Simons Island*	Glynn	3	[redacted]	5-May-03	71 **WOST**, GREG, TRCH, BCNH, ANHI
41	St. Simons II*	Glynn			5-May-03	68 **WOST**, GREG, TRCH
42	Harrington Pond*	Glynn	1		5-May-03	no birds nesting
43	Little St. Simons Island*	Glynn	4a		5-May-03	No birds at coordinates, but nesting in slough on south end and in flooded field nw part of island
44	Jekyll Island Golf Course*	Glynn			5-May-03	26 pair in one dead pine tree.
45	Spivey Pond	Glynn			5-May-03	SNEG, GREG, LBHE
46	Big Dukes Pond*[1]	Jenkins				**67 WOST** surveyed by L. Bryan
47	Chew Millpond*[1]	Jenkins				**135 WOST** surveyed by L. Bryan
48	River Bend WMA	Laurens				Unknown location drop from list
49	Colonel's Island Youman's Pond	Liberty	26		5-May-03	water but no nesting
50	Colonel's Island Drum Point	Liberty	25		5-May-03	full of water but no nesting in willows
51	Riceboro	Liberty	25a		5-May-03	lots of nesting, DCCO, GREG, SNEG, TCHE, LBHE,
52	St. Catherines Windmill Pond*	Liberty	10		5-May-03	GREG
53	St. Catherines Wamassee Pond	Liberty	9-Jan		5-May-03	SNEG
54	Sunbury-A*	Liberty	24		5-May-03	water no nesting
55	Malcolm's Rookery*	Long	27		5-May-03	**8 WOST**, other waders
56	Jumping Gully	Lowndes	18z		5-May-03	300 CAEG, 200 LBH
57	Mud Swamp	Lowndes	17z		5-May-03	Water and birds nesting Bog area
58	Hahira*	Lownes				Did not survey
59	Creighton Island-A	McIntosh	29		5-May-03	water, no birds

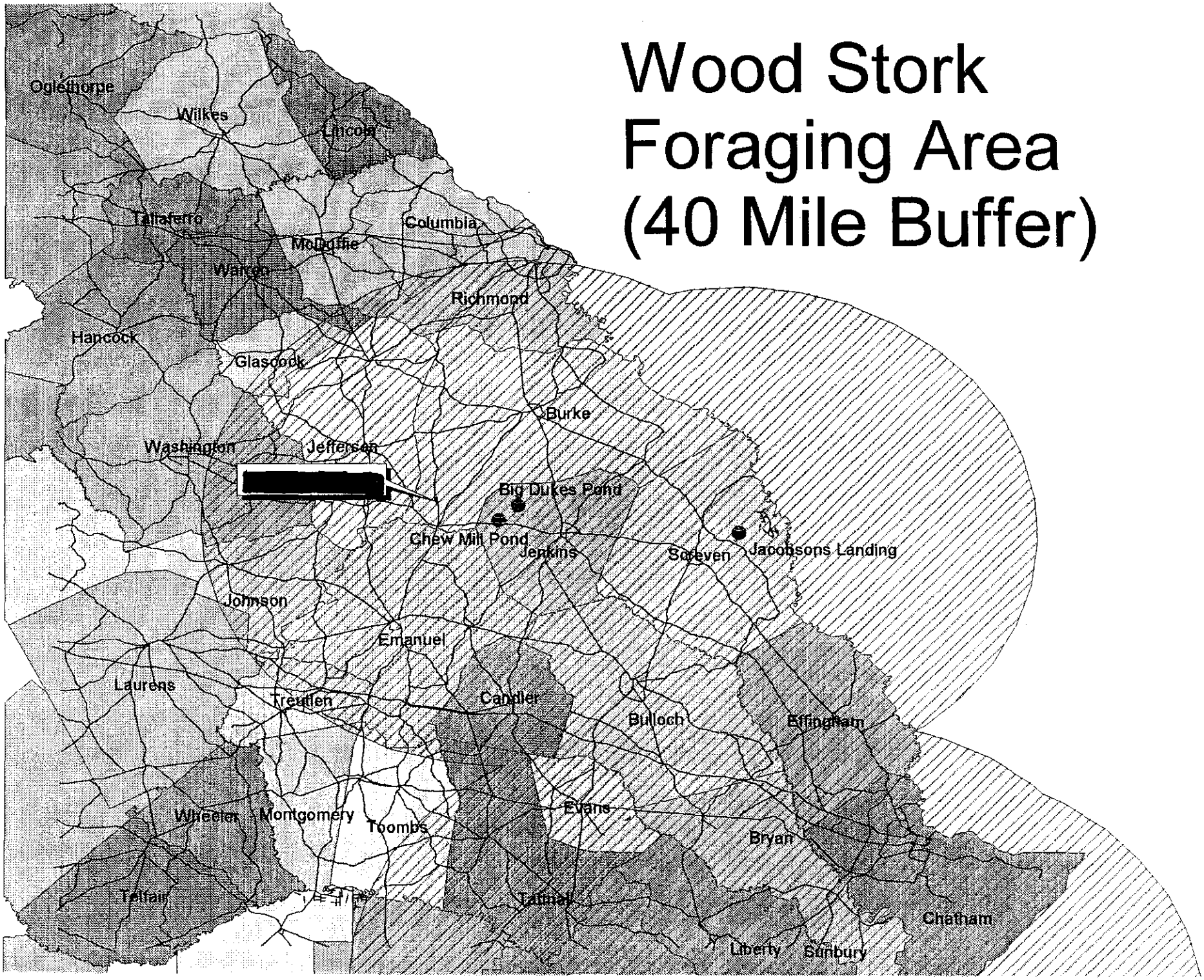
[redacted]

[1]Data provided by Larry Bryan, Savannah River Ecology Lab
[2]Data provided by John Robinette, USFWS
*Historical or present wood stork rookery site
**New Wading Bird Location

TABLE 1: KNOWN WADING BIRD COLONIES SURVEYED FOR WOOD STORKS BY AIRCRAFT IN 2003

60	Creighton Island-B	McIntosh	30	[redacted]	5-May-03	water, 1 GTBH, 1 GREG
61	Slivka*	McIntosh	28		5-May-03	**26 WOST**, GREG
62	Harris Neck NWR*[2]	McIntosh				**431 WOST**, surveyed by J. Robinette, USFWS
63	Marys Hammock	McIntosh	4b		5-May-03	dry
64	Patterson Island*	McIntosh	31		5-May-03	some water
65	Sapelo Island-Cabretta	McIntosh	5		5-May-03	dry
66	Sapelo Island-Tanner	McIntosh	6		5-May-03	GREG, SNEG
67	Sapelo Island-Duck Pond	McIntosh	7		5-May-03	Very low water, no birds
68	Sapelo South End Creek*	McIntosh			5-May-03	**10 WOST**
69	Lewis Island*	McIntosh	33		5-May-03	
70	Ardick	McIntosh				Did not survey
71	Blackbeard Island*	McIntosh	8		5-May-03	20 GREG and SNEG
72	Tolomato Pond	McIntosh	32		5-May-03	no nesting, pond has gone saline, nesting shrubs gone
73	Lee Pond	Screven				coordinates off, could not find
74	Jacobson's Landing*	Screven			5-May-03	
75	Heard's Pond*	Thomas	9z		6-May-03	no birds, storks to the south in Halls Pond
76	Hall's Pond below Heard's*	Thomas	11z			**65 WOST**
77	Thomasville Airport	Thomas	10z		6-May-03	Water, feeding WOST and GREG
78	Paulks Pond?	Turner?				Did not survey
79	Sand Creek Pond**	Turner/Irwin				did not survey

[1]Data provided by Larry Bryan, Savannah River Ecology Lab
[2]Data provided by John Robinette, USFWS
*Historical or present wood stork rookery site
**New Wading Bird Location


Wood Stork
Foraging Area
(40 Mile Buffer)
Oglethorpe
Wilkes
Lincoln
Taliaferro
Columbia
McDuffie
Warren
Richmond
Hancock
Glascock
Burke
Washington
Jefferson
Big Dukes Pond
Chew Mill Pond
Jenkins
Screven
Jacobsons Landing
Johnson
Emanuel
Laurens
Treutlen
Candler
Bulloch
Effingham
Evans
Wheeler
Montgomery
Toombs
Bryan
Telfair
Tattnall
Chatham
Liberty
Bunbury

Eagle Nests 2003

				no. fledged
44	Clarks Hill east2 H	McDuffie		occ
45	Fort Benning I	Chattahooche		
46	Fort Benning west I	Chattahooche		1
47	Little St. Simons	Glynn		2
48	Woods Cut	McIntosh		2
49	Union Camp	McIntosh		occ
50	IP Southlands HQ	Decatur		1
51	Moss Island	Liberty		1
52	Banks Lake	Lanier		
53	Carters Lake	Murray		occ
54	Lake Blackshear	Lee		2
55	Grassy Pond	Lowndes		1
56	Millpond	Thomas		1
57	Allatoona	Cherokee		2
58	West Point Antioch	Troup		2
59	West Point 219	Troup		
60	Goat Rock Mulberry	Harris	occ	
61	Williams Bluff	Early		
62	Williams Bluff2	Early		1
63	River Junction L	Decatur		
64	Spring Creek east J	Decatur	occ	
65	Spring Creek west J	Seminole		
66	Pretoria	Dougherty		1
67	Forest City Gun Club K	Chatham		
68	Vernonburg K	Chatham		2
69	Ossabaw (South end)	Chatham	occ	
70	Clarks Hill Mistletoe M	Columbia		
71	Reynolds Plantation	Greene		1
72	Hartwell Dam	Hart		1
73	Bay Meadows	Coffee	occ	
74	Spring Creek mouth	Decatur		1
75	Lake Nottely	Union		
76	Clarks Hill Graball R	Lincoln		
77	Hesters Ferry R	Lincoln		
78	Hesters Ferry2 R			1
79	Baileys Mill	Camden	(1x) 1	
80	Ford Plantation	Bryan		
81	River Hill S	Early		
82	River Hill 2 S	Early	occ	
83	Sinclair T	Hancock		
84	Cumberland Island	Camden		1
85	Long Pond	Lowndes		1
86	Bussey Point	Lincoln		
87	Louisville	Jefferson		2

Eagle Nests 2003

					no. fledged
88	Sea Island	Glynn	[redacted]		3
89	Clarks Hill Woodlawn M	Lincoln			
90	Goat Rock North	Harris		occ	
91	Seminole west	Seminole			
92	Little Tybee Island	Chatham		occ	
93	Big Haynes Creek	Rockdale			
94	Sinclair Dam T	Baldwin			
95	Kolomoki Creek	Early			2
96	Cow Island	McIntosh			2
97	Harris Neck	Liberty			2
98	Bateau Pond	Decatur			2
99	Sapelo	McIntosh			1
100	Wassaw	Chatham		occ	
101	Lebanon Plantation	Chatham			2
102	Plant Wansley U	Heard			
103	Wansley south U	Heard			1
104	Cool Branch V	Quitman		occ	
105	Cool Branch north V	Quitman			
106	Murray Creek	Lincoln			
107	Murray Creek 2	Lincoln		occ	
108	Broad River	Lincoln			
109	Broad River2	Wilkes			2
110	Aucilla Plantation	Thomas			1
111	Horse Stomp	Camden			1
112	Lake Oconee Cold Springs	Greene			2
113	Lake Sinclair 3 T	Baldwin			2
114	Oconee Reynolds south??	Greene			
115	Bowden's Pond	McDuffie			1
116	Modena Island	Chatham			2
117	River View	Harris			2
118	Hopulikit	Bulloch			1
119	Southlands north	Decatur			2
120	West Point WMA west	Heard			2
121	Creighton Island	McIntosh			
122	Eufaula Bagby	Clay			3
123	Big Lazer WMA	Talbot			2
124	Moody Forest	Appling			
125	Camp Pasture	Seminole			1
126	Wingate East	Decatur		occ	
127	Myrtle Grove	Bryan			1
128	Ocean Pond	Lowndes			2
129	Harrietts Bluff	Camden			1
130	Soapstone Creek	Quitman			2
131	Kolomoki Plantation	Early			1

North Carolina
Department of Administration

Michael F. Easley, Governor

Gwynn T. Swinson, Secretary

November 6, 2003

Ms. Brenda Cook
Department of the Air Force
HQ ACC/CEVP
129 Andrews St - Suite 102
Langley AFB, VA 23665

Dear Ms. Cook:

Re: SCH File # 04-E-0000-0066; Scoping; USAF proposes to assess the potential environmental impact of employing a mobile laser evaluator system (LES-M), to support training by the 20th FW of Shaw Air Force Base SC.

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act. Attached to this letter for your consideration are the comments made by agencies in the course of this review.

If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,

Ms. Chrys Baggett
Environmental Policy Act Coordinator

Attachments

cc: Region R

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail Chrys.Baggett@ncmail.net

Location Address:
116 West Jones Street
Raleigh, North Carolina

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

STATE NUMBER: 04-E-0000-0066 F03
DATE RECEIVED: 09/12/2003
AGENCY RESPONSE: 10/07/2003
REVIEW CLOSED: 10/12/2003

MR TOM ELLIS
CLEARINGHOUSE COORDINATOR
DEPT OF AGRICULTURE
AGRICULTURE BLDG
RALEIGH NC

REVIEW DISTRIBUTION
ALBEMARLE REG PLANNING COMM
CC&PS - DEM, NFIP
DEHNR - COASTAL MGT
DENR LEGISLATIVE AFFAIRS
DEPT OF AGRICULTURE
DEPT OF CUL RESOURCES
DEPT OF TRANSPORTATION

PROJECT INFORMATION
APPLICANT: Department of the Air Force
TYPE: National Environmental Policy Act
ERD: Scoping
DESC: USAF proposes to assess the potential environmental impact of employing a mobile laser evaluator system (LES-M), to support training by the 20th FW of Shaw Air Force Base SC.

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.
If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED:

☑ NO COMMENT

☐ COMMENTS ATTACHED

SIGNED BY: Tom Ellis

DATE: 9-17-03

Agency Comment Letters on Draft EA

United States Department of the Interior

Fish and Wildlife Service
247 South Milledge Avenue
Athens, Georgia 30605

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

APR 23 2004

Ms. Brenda W. Cook
Headquarters Air Combat Command/CEVP
129 Andrews Street, Suite 102
Langley AFB, Virginia 23665-2769

Re: FWS Log No. 04-0245

Dear Ms. Cook:

Thank you for your March 11, 2004, letter and Finding of No Significant Impact (FONSI) which we received on March 28, 2004. We note that you have included our November 4, 2003, technical assistance letter in your FONSI detailing the federally-listed species that could be in the Bulldog A/B Military Operations Area (MOA). This action involves the employment of a Mobile Laser Evaluator System (LES-M) to support laser training by the 20th Fighter Wing of Shaw Air Force Base, South Carolina. We note that the number of F-16 sorties per year in the Bulldog A/B MOA will remain the same at 5523 during the day and 66 at night.

We concur with your determination that this action is not likely to adversely affect federally-listed species. In view of this, we believe that the requirements of section 7 of the Endangered Species Act have been satisfied. However, obligations under section 7 of the Act must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner which was not previously considered in this assessment; or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

If you have any questions or require further information, please contact staff biologist Kathy Chapman at 912-265-9336 ext. 24 or email kathy_chapman@darientel.net.

Sincerely,

Sandra S. Tucker

Sandra S. Tucker
Field Supervisor

April 13, 2004

Ms. Brenda W. Cook
Headquarters Air Combat Command/CEVP
129 Andrews Street, Suite 102
Langley AFB VA 23665-2769

RE: Draft Environmental Assessment (EA) for Employment of a Mobile Laser Evaluator System (LES-M) for the 20th Fighter Wing at Shaw Air Force Base, SC

Dear Ms. Cook:

Thank you for the EA on the above-referenced proposal for employment of a LES-M for the 20th Fighter Wing at Shaw AFB.

We concur with your assessment that no historic properties will be affected by the proposed undertaking.

These comments are provided to assist you with responsibilities pursuant to Section 106 of the National Historic Preservation Act, as amended. If you have any questions, please contact me at (803) 896-6169. Thank you.

Sincerely,

Marta Matthews
Review and Compliance Coordinator
State Historic Preservation Office

North Carolina
Department of Administration

Michael F. Easley, Governor

Gwynn T. Swinson, Secretary

April 14, 2004

Ms. Brenda Cook
Department of the Air Force
HQ ACC/CEVP
129 Andrews St - Suite 102
Langley AFB, VA 23665

Dear Ms. Cook:

Re: SCH File # 04-E-0000-0255; Environmental Assessment/Finding of No Significant Impact; Potential impact of employing a mobile laser evaluator system (LES-M), to support training by the 20th FW of Shaw AFB SC. EA on Shaw AFB website at www.shaw.af.mil

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act.

No comments were made by any state/local agencies during the course of this review. If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,

Chrys Baggett

Ms. Chrys Baggett
Environmental Policy Act Coordinator

cc: Region R

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail Chrys.Baggett@ncmail.net

Location Address:
116 West Jones Street
Raleigh, North Carolina

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

RECEIVED
MAR 17 2004
HISTORIC PRESERVATION OFFICE

STATE NUMBER: 04-E-0000-0255 G01
DATE RECEIVED: 03/16/2004
AGENCY RESPONSE: 04/07/4004
REVIEW CLOSED: 04/12/4004

MS RENEE GLEDHILL-EARLEY
CLEARINGHOUSE COORD
DEPT OF CUL RESOURCES
ARCHIVES-HISTORY BLDG - MSC 4617
RALEIGH NC

Ref # ER03-2480
Ack'd by both 1/5/04

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CC&PS - DEM, NFIP
DEHNR - COASTAL MGT
DENR LEGISLATIVE AFFAIRS
DEPT OF CUL RESOURCES
DEPT OF TRANSPORTATION

MAR 2004
RECEIVED
Secretary's Office
DOA

PROJECT INFORMATION
APPLICANT: Department of the Air Force
Dare Co.
TYPE: National Environmental Policy Act
ERD: Environmental Assessment/Finding of No Significant Impact
DESC: USAF proposes to assess the potential environmental impact of employing a mobile laser evaluator system (LE5-M), to support training by the 20th FW of Shaw Air Force Base SC. Draaft EA on Shaw AFB website at www.shaw.af.mil
CROSS-REFERENCE NUMBER: 04-E-0000-0066

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.
If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED:

☒ NO COMMENT

☐ COMMENTS ATTACHED

SIGNED BY: Renee Gledhill-Earley

DATE: 3-18-04

Office of Planning and Budget

Sonny Perdue
Governor

Timothy A. Connell
Director

GEORGIA STATE CLEARINGHOUSE MEMORANDUM
EXECUTIVE ORDER 12372 REVIEW PROCESS

TO: Brenda Cook
Headquarters Air Combat Command/CEVP
129 Andrews Street, Ste. 102
Langley AFB, VA 23665-2769

FROM: Barbara Jackson
Georgia State Clearinghouse

DATE: 4/19/2004

SUBJECT: Executive Order 12372 Review

APPLICANT: Dept. of the Air Force – Shaw AFB

PROJECT: Draft EA/FONSI: Employment of Mobile Laser Evaluator System (LES-M) for 20th Fighter Wing at Shaw AFB, SC

STATE ID: GA040319001

The applicant is advised that the Central Savannah River RDC and the Wildlife Resources Division were included in this review but chose not to comment within the review period. Should they later submit comments, we will forward to you.

The applicant is advised to note comments from DNR's Historic Preservation Division. Future interaction on this project between the applicant and this agency will preclude further State Clearinghouse involvement.

/bj
Enc.: Air Protec Branch, Apr. 8, 2004
HPD, Apr. 5, 2004

270 Washington Street, S.W., Atlanta, Georgia 30334
An Equal Opportunity Employer

GEORGIA STATE CLEARINGHOUSE MEMORANDUM
EXECUTIVE ORDER 12372 REVIEW PROCESS

TO: Barbara Jackson
Georgia State Clearinghouse
270 Washington Street, SW, Eighth Floor
Atlanta, Georgia 30334

FROM: MR. RON METHIER
AIR PROTECTION BRANCH

SUBJECT: Executive Order 12372 Review

APPLICANT: Department of the Air Force - Shaw AFB, SC

PROJECT: Draft EA/FONSI: Employment of Mobile Laser Evaluator System (LES-M) for 20th Fighter Wing at Shaw AFB, SC

STATE ID: GA040319001

DATE:

☑ This notice is considered to be consistent with those state or regional goals, policies, plans, fiscal resources, criteria for developments of regional impact, environmental impacts, federal executive orders, acts and/or rules and regulations with which this organization is concerned.

This notice is not consistent with:

☐ The goals, plans, policies, or fiscal resources with which this organization is concerned. (Line through inappropriate word or words and prepare a statement that explains the rationale for the inconsistency. Additional pages may be used for outlining the inconsistencies).

☐ The criteria for developments of regional impact, federal executive orders, acts and/or rules and regulations administered by your agency. Negative environmental impacts or provision for protection of the environment should be pointed out. (Additional pages may be used for outlining the inconsistencies).

☐ This notice does not impact upon the activities of the organization.

RECEIVED
APR 8 2004
GEORGIA
STATE CLEARINGHOUSE

Georgia Department of Natural Resources

Lonice C. Barrett, Commissioner

Historic Preservation Division

W. Ray Luce, Division Director and Deputy State Historic Preservation Officer
47 Trinity Avenue, S.W., Suite 414-H, Atlanta, Georgia 30334
Telephone (404) 656-2840 Fax (404) 657-1040 http://www.gashpo.org

MEMORANDUM

TO: Barbara Jackson
Georgia State Clearinghouse
Office of Planning and Budget

FROM: Serena G. Bellew
Environmental Review Coordinator
Historic Preservation Division

RE: Results of Project Review

Applicant: Department of the Air Force, Shaw Air Force Base, South Carolina

Project: **Employ Mobile Laser Evaluator System (LES-M), Shaw Air Force Base, South Carolina**

Control Number: **GA-040319-001 (HP-040323-011)**

DATE: March 30, 2004

The Historic Preservation Division (HPD) has received information concerning this undertaking directly from the project applicant, in accordance with Section 106 of the National Historic Preservation Act. All HPD review comments concerning this undertaking will be submitted directly to the project applicant.

SGB:mcv

cc: Maurice Ungaro, Atlanta Regional Commission
Anne Floyd, Central Savannah River Area RDC
Lynne Miller, Chattahoochee-Flint RDC
Iris Scheff, Coastal Georgia RDC
Dan Latham, Jr., Coosa Valley RDC
Bryan Flower, Georgia Mountains RDC
Robin Nail, Heart of Georgia – Altamaha RDC
Allison Slocum, Lower Chattahoochee RDC
Adam Hazell, McIntosh Trail RDC
Ebony White, Middle Flint RDC
Middle Georgia RDC
Kevin McAuliff, North Georgia RDC
Burke Walker, Northeast Georgia RDC
Andrea MacDonald, South Georgia RDC
Michael Jacobs, Southeast Georgia RDC
Alex MacDonald, Southwest Georgia RDC

Lonice C. Barrett, Commissioner

Georgia Department of Natural Resources

Historic Preservation Division

W. Ray Luce, Division Director and Deputy State Historic Preservation Officer
47 Trinity Avenue, S.W., Suite 414-H, Atlanta, Georgia 30334
Telephone (404) 656-2840 Fax (404) 657-1040 http://www.gashpo.org

MEMORANDUM

TO: Ms. Brenda W. Cook
Headquarters Air Combat Command/CEVP
129 Andrews Street, Suite 102
Langley AFB, VA 23665-2769

FROM: Serena G. Bellew SGB
Environmental Review Coordinator
Historic Preservation Division

RE: **Finding of "No Historic Properties Affected"**

PROJECT: **Employ Mobile Laser Evaluator System (LES-M)**
Shaw Air Force Base, South Carolina
Federal Agency: Air Force
HP 040323-011

COUNTIES: **Statewide, Georgia**

DATE: April 27, 2004

The Historic Preservation Division has reviewed the information received concerning the above-referenced project. Our comments are offered to assist federal agencies and project applicants in complying with the provisions of Section 106 of the National Historic Preservation Act.

Based on the information submitted, HPD has determined that no historic properties or archaeological resources that are listed in or eligible for listing in the National Register of Historic Places will be affected by this undertaking. Please note that historic and/or archaeological resources may be located within the project's area of potential effect (APE), however, at this time it has been determined that they will not be impacted by the above-referenced project. Furthermore, any changes to this project as proposed will require further review by our office for compliance with the Section 106 process.

If we may be of further assistance contact me at (404) 651-6624. Please refer to the project number assigned above in any future correspondence regarding this project.

SGB:mcv

cc: 1Lt. Jean Van Allen, Air Force
Paul R. Green, Air Force

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

April 7, 2004

Ms. Brenda W. Cook
Headquarters Air Combat Command/CEVP
129 Andrews Street, Suite 102
Langley AFB VA 23665-2769

Re: Draft EA for Employment of a Mobile Laser Evaluator System (LES-M) for the 20th Fighter Wing at Shaw Air Force Base
FWS Log No: 4-6-04-I-211

Dear Ms. Cook:

The U.S. Fish and Wildlife Service (Service) has reviewed your March 11, 2004, draft environmental assessment requesting concurrence with the Air Force's conclusion of no significant effects on listed species regarding the above referenced project. The proposed project would involve employment of a LES-M for use by the 20th Fighter Wing. The proposed project is to take place on Shaw Air Force Base, Sumter County, South Carolina. The following comments are provided in accordance with section 7 of the Endangered Species Act (Act), as amended (16 U.S.C. 1531-1543).

Although the Federally endangered red cockaded woodpecker and bald eagle are known to occur on Shaw Air Force Base, there is no indication that the employment of a LES-M will result in take of federally protected species. The Ecological Assessment indicates that use of LES-M will not change the current airspace use, configuration, or flight frequency in the Bulldog or Gamecock Military Operations Areas (MOA). No construction or facility changes are required for implementation of LES-M; therefore no impacts to land use are expected. Potential endangered species impacts resulting from the current military flight operations are discussed in the Ecological Assessment for Bulldog and Gamecock MOAs.

Based on information provided, we concur with your determination that the proposed action will have no significant effect on resources under the jurisdiction of the Service that are currently protected by the Act. In view of this, the Service believes that the requirements of Section 7 of the Act have been fulfilled relative to the proposed action, and no further consultation is necessary at this time. However, obligations under Section 7 of the Act must be reconsidered if: (1) new information reveals that the proposed project may affect listed species in a manner or to an extent not previously considered, (2) the proposed project is subsequently modified to include activities which were not

considered during this consultation; or (3) new species are listed or critical habitat designated that might be affected by the proposed project.

Your interest in ensuring the protection of endangered species is appreciated. If you have further questions or require additional information, please contact Lora Zimmerman of this office at (843) 727-4707 ext. 23. In future correspondence concerning this project, please reference FWS Log No. 4-6-04-I-211.

Sincerely,

Timothy N. Hall
Field Supervisor

TNH/LLZ

APPENDIX C
SOUTH CAROLINA DISTRIBUTION RECORDS OF ENDANGERED, THREATENED, CANDIDATE AND SPECIES OF CONCERN

South Carolina Distribution Records of
Endangered, Threatened, Candidate and Species of Concern
March 1, 2003

E Federally endangered
T Federally threatened
P Proposed in the Federal Register
CH Critical Habitat
C The U.S. Fish and Wildlife Service or the National Marine Fisheries Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species
S/A Federally protected due to similarity of appearance to a listed species
SC Federal Species of concern. These species are rare or limited in distribution but are not currently legally protected under the Endangered Species Act.
* Contact the National Marine Fisheries Service for more information on this species

These lists should be used only as a guideline, not as the final authority. The lists include known occurrences and areas where the species has a high possibility of occurring. Records are updated continually and may be different from the following.

County	Common Name	Scientific Name	Status	Occurrence
Abbeville				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Georgia aster	*Aster georgianus*	C	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
Aiken				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Relict trillium	*Trillium reliquum*	E	Known
	Piedmont bishop-weed	*Ptilimnium nodosum*	E	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
	Small-flowered buckeye	*Aesculus parviflora*	SC	Known
	Sandhills milk-vetch	*Astragalus michauxii*	SC	Known
	Elliott's croton	*Croton elliottii*	SC	Known

County	Common Name	Scientific Name	Status	Occurrence
	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
Aiken				
cont.	White-wicky	*Kalmia cuneata*	SC	Known
	Bog spicebush	*Lindera subcoriacea*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Awned-meadowbeauty	*Rhexia aristosa*	SC	Known
	Pickering's morning-glory	*Stylisma pickeringii var. pickeringii*	SC	Known
	Reclined meadow-rue	*Thalictrum subrotundum*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Redhorse, Robust	Moxostoma robustum	SC	Known
	Arogos skipper	*Atrytone arogos arogos*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Gopher tortoise	*Gopherus polyphemus*	SC	Known
	Southern hognose snake	Heterodon simus	SC	Known
	Pine or Gopher snake	*Pituophis melanoleucus melanoleucus*	SC	Known
Allendale				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Possible
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible

County	Common Name	Scientific Name	Status	Occurrence
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
	Savannah lilliput	*Toxolasma pullus*	SC	Known
	Bluebarred pygmy sunfish	*Elassoma okatie*	SC	Known
Allendale				
cont.	Gopher tortoise	*Gopherus polyphemus*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Anderson				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Fraser's loosestrife	*Lysimachia fraseri*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Carolina darter	*Etheostoma collis*	SC	Known
Bamberg				
	Wood stork	*Mycteria americana*	E	Possible
	Red-cockaded woodpecker	*Picoides borealis*	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Chapman's sedge	*Carex chapmanii*	SC	Known
	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
Barnwell				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Possible
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Pondberry	*Lindera melissifolia*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Piedmont bishop-weed	*Ptilimnium nodosum*	E	Known
	American chaffseed	*Schwalbea americana*	E	Possible
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible

County	Common Name	Scientific Name	Status	Occurrence
	Gopher frog	*Rana capito*	SC	Known
	Sandhills milk-vetch	*Astragalus michauxii*	SC	Known
	Elliott's croton	*Croton elliottii*	SC	Known
Barnwell				
cont.	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Bog spicebush	*Lindera subcoriacea*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Beaufort				
	West Indian manatee	*Trichechus manatus*	E	Known
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Known
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Known
	Flatwoods salamander	*Ambystoma cingulatum*	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Pondberry	*Lindera melissifolia*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Cupgrass	*Eriochloa michauxii*	SC	Known
	Godfrey's privet	*Forestiera godfreyi*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Red knot	*Calidris canutus*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known

County	Common Name	Scientific Name	Status	Occurrence
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
Beaufort				
cont.	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	Sterna nilotica	SC	Known
	Hilton Head white-tail deer	*Odocoileus virginianus hiltonensis*	SC	Known
	Hunting Island white-tail deer	*Odocoileus virginianus venatoria*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Berkeley				
	West Indian manatee	*Trichechus manatus*	E	Possible
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Flatwoods salamander	*Ambystoma cingulatum*	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Pondberry	*Lindera melissifolia*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
	Incised groovebur	*Agrimonia incisa*	SC	Known
	Wagner's spleenwort	*Asplenium heteroresiliens*	SC	Known
	Chapman's sedge	*Carex chapmanii*	SC	Known
	Ciliate-leaf tickseed	*Coreopsis integrifolia*	SC	Known
	Angiosperm (no common name)	*Elytraria caroliniensis*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Brown beaked-rush	*Rhynchospora pleiantha*	SC	Known
	Sun-facing coneflower	*Rudbeckia heliopsidis*	SC	Known
	Biltmore green briar	Smilax biltmoreana	SC	Known
	Reclined meadow-rue	*Thalictrum subrotundum*	SC	Known

County	Common Name	Scientific Name	Status	Occurrence
	Least trillium	*Trillium pusillum var. pusillum*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
Berkeley				
cont.	Black-throated green warbler	*Dendroica virens*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Calhoun				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Possible
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Least trillium	*Trillium pusillum var. pusillum*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
Charleston				
	West Indian manatee	*Trichechus manatus*	E	Known
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Bachman's warbler	*Vermivora bachmanii*	E	Known
	Wood stork	*Mycteria americana*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Known
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Known
	Flatwoods salamander	*Ambystoma cingulatum*	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known

County	Common Name	Scientific Name	Status	Occurrence
	Sea-beach amaranth	*Amaranthus pumilus*	T	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Pondberry	*Lindera melissifolia*	E	Possible
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
Charleston				
cont.	Incised groovebur	*Agrimonia incisa*	SC	Known
	Venus' fly-trap	*Dionaea muscipula*	SC	Known
	Angiosperm (no common name)	*Elytraria caroliniensis*	SC	Known
	Godfrey's privet	*Forestiera godfreyi*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Red knot	*Calidris canutus*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Black rail	*Laterallus jamaicensis*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	Sterna nilotica	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Bull's Island white-tail deer	*Odocoileus virginianus taurinsulae*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
	Island glass lizard	*Ophisaurus compressus*	SC	Known
Cherokee				

County	Common Name	Scientific Name	Status	Occurrence
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T	Known
	Georgia aster	*Aster georgianus*	C	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Biltmore green briar	Smilax biltmoreana	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Southeastern myotis	*Myotis austroriparius*	SC	Known
Chester				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Possible
	Georgia aster	*Aster georgianus*	C	Known
	Dwarf aster	*Aster mirabilis*	SC	Possible
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
Chesterfield				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Dwarf aster	*Aster mirabilis*	SC	Possible
	Sandhills milk-vetch	*Astragalus michauxii*	SC	Known
	White-wicky	*Kalmia cuneata*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Algae-like pondweed	*Potamogeton confervoides*	SC	Known
	Well's pixie-moss	*Pyxidanthera brevifolia*	SC	Known
	Spring-flowering goldenrod	*Solidago verna*	SC	Known
	Carolina dropseed	*Sporobolus sp1*	SC	Known
	Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known
	Smooth bog-asphodel	*Tofieldia glabra*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible

County	Common Name	Scientific Name	Status	Occurrence
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Painted bunting	*Passerina ciris ciris*	SC	Known
	Redhorse, Robust	Moxostoma robustum	SC	Possible
	Southern hognose snake	*Heterodon simus*	SC	Known
	Northern pine snake	*Pituophis melanoleucus melanoleucus*	SC	Known
Clarendon				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Elliott's croton	*Croton elliottii*	SC	Known
	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Southern bog-button	*Lachnocaulon beyrichianum*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Spring-flowering goldenrod	*Solidago verna*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
Colleton				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Known
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Pondberry	*Lindera melissifolia*	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Angiosperm (no common	*Elytraria caroliniensis*	SC	Known

County	Common Name	Scientific Name	Status	Occurrence
	name)			
	Godfrey's privet	*Forestiera godfreyi*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Carolina bird-in-a-nest	*Macbridea caroliniana*	SC	Known
	Crested fringed orchid	*Pteroglossaspis ecristata*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
Colleton				
cont.	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Red knot	*Calidris canutus*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Black rail	*Laterallus jamaicensis*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	*Sterna nilotica*	SC	Known
	Bluebarred pygmy sunfish	*Elassoma okatie*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
	Island glass lizard	*Ophisaurus compressus*	SC	Known
Darlington				
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Georgia lead-plant	*Amorpha georgiana var. georgiana*	SC	Known
	Sandhills milkvetch	*Astragalus michauxii*	SC	Known
	Honeycomb head	*Balduina atropurpurea*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	White-wicky	*Kalmia cuneata*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Well's pixie-moss	*Pyxidanthera brevifolia*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Spring-flowering goldenrod	*Solidago verna*	SC	Known
	White false-asphodel	*Tofieldia glabra*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible

County	Common Name	Scientific Name	Status	Occurrence
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Madtom, broadtail	Noturus sp 2	SC	Possible
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known

Dillon				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Sandhills milkvetch	*Astragalus michauxii*	SC	Known
	Pine barrens bonneset	*Eupatorium resinosum*	SC	Known
	Southern bog-button	*Lachnocaulon beyrichianum*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Falso coco	*Pteroglossaspis ecristata*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
Dorchester				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Possible
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Pondberry	*Lindera melissifolia*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Bog asphodel	*Narthecium americanum*	C	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
	Chapman's sedge	*Carex chapmanii*	SC	Known
	Angiosperm (no common name)	*Elytraria caroliniensis*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Least trillium	*Trillium pusillum var. pusillum*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible

	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Painted bunting	*Passerina ciris ciris*	SC	Possible
Dorchester				
cont.	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Gopher tortoise	*Gopherus polyphemus*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
Edgefield				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Miccosukee gooseberry	*Ribes echinellum*	T	Possible
	Relict trillium	*Trillium reliquum*	E	Known
	Georgia aster	*Aster georgianus*	C	Known
	Dwarf aster	*Aster mirabilis*	SC	Possible
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Brook floater	*Alasmidonta varicosa*	SC	Known
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
Fairfield				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Georgia aster	*Aster georgianus*	C	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Carolina darter	*Etheostoma collis*	SC	Known
Florence				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Chaffseed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Georgia lead-plant	*Amorpha georgiana var.*	SC	Known

		georgiana		
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
Florence				
cont.	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Ovate catchfly	*Silene ovata*	SC	Known
	White false-asphodel	*Tofieldia glabra*	SC	Known
	Bachman's sparrow	*Aimophila aestivalis*	SC	Possible
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Madtom, broadtail	Noturus sp 2	SC	Possible
Georgetown				
	West Indian manatee	*Trichechus manutus*	E	Known
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Wood stork	*Mycteria americana*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Known
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Sea-beach amaranth	*Amaranthus pumilus*	T	Known
	Pondberry	*Lindera melissifolia*	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Chaffseed	*Schwalbea americana*	E	Possible
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Georgia lead-plant	*Amorpha georgiana var. georgiana*	SC	Known
	One-flower balduina	*Balduina uniflora*	SC	Known
	Venus' fly-trap	*Dionaea muscipula*	SC	Known
	Southern bog-button	*Lachnocaulon beyrichianum*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Carolina grass-of-parnassus	*Parnassia caroliniana*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known

	Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known
	Reclined meadow-rue	*Thalictrum subrotundum*	SC	Known
Georgetown				
cont.	Dune bluecurls	*Trichostema sp 1*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Red knot	*Calidris canutus*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Black rail	*Laterallus jamaicensis*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	Sterna nilotica	SC	Known
	Carolina pygmy sunfish	*Elassoma boehlkei*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
	Pine or Gopher snake	*Pituophis melanoleucus melanoleucus*	SC	Known
Greenville				
	Bog turtle	*Clemmys muhlenbergii*	T S/A	Known
	Swamp-pink	*Helonias bullata*	T	Known
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T	Known
	Small whorled pogonia	*Isotria medeoloides*	T	Known
	Bunched arrowhead	*Sagittaria fasciculata*	E	Known
	Mountain sweet pitcher-plant	*Sarracenia rubra ssp. jonesii*	E	Known
	White irisette	*Sisyrinchium dichotomum*	E	Known
	Rock gnome lichen	*Gymnoderma lineare*	E	Known
	White fringeless orchid	*Platanthera integrilabia*	C	Known
	Green salamander	*Aneides aeneus*	SC	Known
	Cuthbert turtlehead	*Chelone cuthberti*	SC	Possible
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Piedmont ragwort	*Senecio millefolium*	SC	Known
	Oconee-bells	*Shortia galacifolia*	SC	Known
	Biltmore green briar	*Smilax biltmoreana*	SC	Known
	Granite dome goldenrod	*Solidago simulans*	SC	Possible

	Cerulean warbler	*Dendroica cerulea*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	American kestrel	*Falco sparverius*	SC	Possible
Greenville cont.				
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Red crossbill	*Loxia curvirostra*	SC	Known
	Wren, Appalachian Bewick's	*Thryomanes bewickii altus*	SC	Known
	Golden-winged warbler	*Vermivora chrysoptera*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Southern Appalachian woodrat	*Neotoma floridana haematoreia*	SC	Known
Greenwood				
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
Hampton				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Wood stork	*Mycteria americana*	E	Known
	Eastern indigo snake	*Drymarchon corais couperi*	T	Possible
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
	Chapman's sedge	*Carex chapmanii*	SC	Known
	Angiosperm (no common name)	*Elytraria caroliniensis*	SC	Known
	Boykin's lobella	*Lobelia boykinii*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible

	Bluebarred pygmy sunfish	*Elassoma okatie*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
Hampton				
cont.	Northern pine snake	*Pituophis melanoleucus melanoleucus*	SC	Known
Horry				
	West Indian manatee	*Trichechus manutus*	E	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Known
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Possible
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Sea-beach amaranth	*Amaranthus pumilus*	T	Known
	Pondberry	*Lindera melissifolia*	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Georgia lead-plant	*Amorpha georgiana var. georgiana*	SC	Known
	One-flower balduina	*Balduina uniflora*	SC	Known
	Ciliate-leaf tickseed	*Coreopsis integrifolia*	SC	Known
	Venus' fly-trap	*Dionaea muscipula*	SC	Known
	Dwarf burhead	*Echinodorus parvalus*	SC	Known
	Harper's fimbristylis	*Fimbristylis perpusilla*	SC	Known
	Southern bog-button	*Lachnocaulon beyrichianum*	SC	Known
	Pondspice	*Litsea astivalis*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Carolina grass-of parnassus	*Parnassia caroliniana*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	Crested fringed orchid	*Pteroglossaspis ecristata*	SC	Known
	Well's Pyxie Moss	*Pyxidanthera barbulata var. barbulata*	SC	Known
	Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known

	Pickering's morning-glory	*Stylisma pickerngii var. pickeringii*	SC	Known
	White false-asphodel	*Tofieldia glabra*	SC	Known
Horry				
cont.	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Red knot	*Calidris canutus*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	Sterna nilotica	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
	Northern pine snake	*Pituophis melanoleucus melanoleucus*	SC	Known
Jasper				
	West Indian manatee	*Trichechus manutus*	E	Known
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Wood stork	*Mycteria americana*	E	Known
	Piping plover	*Charadrius melodus*	T, CH	Possible
	Eastern indigo snake	*Drymarchon corais couperi*	T	Possible
	Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
	Leatherback sea turtle	*Dermochelys coriacea**	E	Known
	Loggerhead sea turtle	*Caretta caretta*	T	Known
	Green sea turtle	*Chelonia mydas**	T	Possible
	Flatwoods salamander	*Ambystoma cingulatum*	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Pondberry	*Lindera melissifolia*	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Creeping St. Johns-wort	*Hypericum adpressum*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Pineland plantain	*Plantago sparsiflora*	SC	Known
	Crested fringed orchid	*Pteroglossaspis ecristata*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known

	Red knot	*Calidris canutus*	SC	Possible
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	American oystercatcher	*Haematopus palliatus*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
Jasper				
cont.	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Gull-billed tern	Sterna nilotica	SC	Known
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
	Bluebarred pygmy sunfish	*Elassoma okatie*	SC	Known
	Tortoise, gopher (eastern pops)	Gopherus polyphemus	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
	Mimic glass lizard	*Ophisaurus mimicus*	SC	Known
	Northern pine snake	*Pituophis melanoleucus melanoleucus*	SC	Known
	Florida pine snake	*Pituophis melanoleucus mugitus*	SC	Known
Kershaw				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Michaux's sumac	*Rhus michauxii*	E	Known
	Georgia aster	*Aster georgianus*	C	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Dwarf aster	*Aster mirabilis*	SC	Possible
	One-flower stitchwort	*inuartia uniflora*	SC	Known
	White-wicky	*Kalmia cuneata*	SC	Known
	Pondspice	*Litsea aestivalis*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known
	White-false-asphodel	*Tofieldia glabra*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known

	Carolina pygmy sunfish	*Elassoma boehlkei*	SC	Known
	Southeastern myotis	*Myotis austroriparius*	SC	Known
Lancaster				
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Little amphianthus	*Amphianthus pusillus*	T	Known
Lancaster cont.	Smooth coneflower	*Echinacea laevigata*	E	Known
	Schweinitz's sunflower	*Helianthus schweinitzii*	E	Known
	Black-spored quillwort	*Isoetes melanospora*	E	Known
	Dwarf aster	*Aster mirabilis*	SC	Possible
	Sandhills milkvetch	*Astragalus michauxii*	SC	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Brook floater	*Alasmidonta varicosa*	SC	Known
Laurens				
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Georgia aster	*Aster georganus*	C	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Biltmore green briar	*Smilax biltmoreana*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Brook floater	*Alasmidonta varicosa*	SC	Known
Lee				
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Chaffseed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Madtom, broadtail	Noturus sp 2	SC	Possible

Lexington				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Smooth coneflower	*Echinacea laevigata*	E	Possible
	Schweinitz's sunflower	*Helianthus schweinitzii*	E	Known
Lexington cont.	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Dwarf aster	*Aster mirabilis*	SC	Possible
	Shoal's spider-lily	*Hymenocallis coronaria*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Piedmont cowbane	*Oxypolis ternata*	SC	Known
	Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known
	Pickering's morning-glory	*Stylisma pickeringii var. pickeringii*	SC	Known
	Rayner's blueberry	*Vaccinium crassifolium ssp sempervirens*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Southern hognose snake	*Heterodon simus*	SC	Possible
Marlon				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Wood stork	*Mycteria americana*	E	Possible
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyii*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Possible
	Northern pine snake	*Pituophis melanoleucus*	SC	Known

		melanoleucus		
Marlboro				
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Possible
	Canby's dropwort	*Oxypolis canbyi*	E	Possible
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
Marlboro				
cont.	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Spring-flowering goldenrod	*Solidago verna*	SC	Known
	Pickering's morning-glory	*Stylisma pickeringii var.* pickeringii	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
	Redhorse, Robust	Moxostoma robustum	SC	Possible
McCormick				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Carolina heelsplitter	*Lasmigona decorata*	E, CH	Known
	Miccosukee gooseberry	*Ribes echinellum*	T	Known
	Georgia aster	*Aster georgianus*	C	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Brook floater	*Alasmidonta varicosa*	SC	Known
	Yellow lampmussel	*Lampsilis cariosa*	SC	Known
Newberry				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Biltmore green briar	*Smilax biltmoreana*	SC	Known
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known

	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Saluda crayfish	*Distocambarus youngineri*	SC	Known
Oconee				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
Oconee				
cont.	Small whorled pogonia	*Isotria medeoloides*	T	Known
	Persistent trillium	*Trillium persistens*	E	Known
	Georgia aster	*Aster georgianus*	C	Known
	Green salamander	*Aneides aeneus*	SC	Known
	Hellbender	*Cryptobranchus alleganiensis*	SC	Known
	Fort mountain sedge	*Carex amplisquama*	SC	Known
	Manhart sedge	*Carex manhartii*	SC	Known
	Cuthbert turtlehead	*Chelone cuthberti*	SC	Possible
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Fraser loosestrife	*Lysimachia fraseri*	SC	Known
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Liverwort (no other name)	*Porella japonica ssp. appalachium*	SC	Known
	Sun-facing coneflower	*Rudbeckia heliopsidis*	SC	Known
	Oconee-bells	*Shortia galacifolia*	SC	Known
	Biltmore green briar	*Smilax biltmoreana*	SC	Known
	Granite dome goldenrod	*Solidago simulans*	SC	Possible
	Piedmont strawberry	*Waldsteinia lobata*	SC	Known
	Cerulean warbler	*Dendroica cerulea*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	American kestrel	*Falco sparverius*	SC	Possible
	Swainson's warbler	*Limnothlypis swainsonii*	SC	Known
	Red crossbill	*Loxia curvirostra*	SC	Known
	Wren, Appalachian Bewick's	*Thryomanes bewickii altus*	SC	Known
	Golden-winged warbler	*Vermivora chrysoptera*	SC	Known
	Brook floater	*Alasmidonta varicosa*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southern appalachian woodrat	*Neotoma floridana haematoreia*	SC	Known
Orangeburg				

	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Flatwoods salamander	*Ambystoma cingulatum*	T	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Gopher frog	*Rana capito*	SC	Known
	Incised groovebur	*Agrimonia incisa*	SC	Known
	Wagner's spleenwort	*Asplenium heteroresiliens*	SC	Known
Orangeburg				
cont.	Pondspice	*Litsea aestivalis*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Buff-breasted sandpiper	*Tryngites subruficollis*	SC	Possible
	Southeastern myotis	*Myotis austroriparius*	SC	Known
	Florida pine snake	Pituophis melanoleucus	SC	Known
		mugitus		
Pickens				
	Bald eagle	*Haliaeetus leucocephalus*	T	Possible
	Bog turtle	*Clemmys muhlenbergii*	T S/A	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T	Possible
	Black-spored quillwort	*Isoetes melanospora*	E	Known
	Mountain sweet pitcher-plant	*Sarracenia rubra ssp. jonesii*	E	Known
	Georgia aster	*Aster georgianus*	C	Known
	Green salamander	*Aneides aeneus*	SC	Known
	Alexander's rock aster	*Aster avitus*	SC	Known
	Fort Mountain sedge	*Carex amplisquana*	SC	Known
	Manhart sedge	*Carex manhartii*	SC	Known
	Radford's sedge	*Carex radfordii*	SC	Known
	Cuthbert turtlehead	*Chelone cuthberti*	SC	Possible
	Tunbridge fern	*Hymenophyllum tunbridgnse*	SC	Known
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Fraser loosestrife	*Lysimachia fraseri*	SC	Known

	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Piedmont ragwort	*Senecio millefolium*	SC	Known
	Oconee-bells	*Shortia galacifolia*	SC	Known
	Biltmore greenbrier	*Smilax biltmoreana*	SC	Known
	Granite dome goldenrod	*Solidago simulans*	SC	Possible
	Cerulean warbler	*Dendroica cerulea*	SC	Possible
	Black-throated green warbler	*Dendroica virens*	SC	Possible
	American kestrel	*Falco sparverius*	SC	Possible
	Red crossbill	*Loxia curvirostra*	SC	Known
Pickens				
cont.	Wren, Appalachian Bewick's	Thryomanes bewickii altus	SC	Possible
	Golden-winged warbler	*Vermivora chrysoptera*	SC	Known
	Margaret's river cruiser	*Macromia margarita*	SC	Known
	Carlson's polycentropis caddisfly	*Polycentropis carlsoni*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southern appalachian woodrat	*Neotoma floridana haematoreia*	SC	Known
Richland				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Smooth coneflower	*Echinacea laevigata*	E	Known
	Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Georgia aster	*Aster georgianus*	C	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Sandhills milk-vetch	*Astragalus michauxii*	SC	Known
	Purple balduina	*Balduina atropurpurea*	SC	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Bog spicebush	*Lindera subcoriacea*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Algae-like pondweed	*Potamogeton confervoides*	SC	known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Reclined meadow-rue	*Thalictrum subrotundum*	SC	Known
	White false-asphodel	*Tofieldia glabra*	SC	Known
	Rayner's blueberry	*Vaccinium crassifolium ssp. empervirens*	SC	Known

	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Carolina darter	*Etheostoma collis*	SC	Known
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Saluda				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Piedmont bishop-weed	*Ptilimnium nodosum*	E	Known
	Little amphianthus	*Amphianthus pusillus*	T	Known
	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Savannah lilliput	*Toxolasma pullus*	SC	Known
	Southern hognose snake	*Heterodon simus*	SC	Known
Spartanburg				
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T	Known
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Biltmore greenbrier	*Smilax biltmoreana*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
Sumter				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Dwarf burhead	*Echinodorus parvulus*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known

	Pineland plantain	*Plantago sparsiflora*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Biltmore greenbrier	*Smilax biltmoreana*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Painted bunting	*Passerina ciris ciris*	SC	Possible
	Madtom, broadtail	Noturus sp 2	SC	Possible
Union				
	Georgia aster	*Aster georgianus*	C	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Butternut	Juglans cinerea	SC	Possible
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
	Sweet pinesap	*Monotropsis odorata*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
Williamsburg				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Wood stork	*Mycteria americana*	E	Possible
	Red-cockaded woodpecker	*Picoides borealis*	E	Known
	Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
	Canby's dropwort	*Oxypolis canbyi*	E	Known
	Chaff-seed	*Schwalbea americana*	E	Known
	Southern Dusky Salamander	*Desmognathus auriculatus*	SC	Possible
	Southern bog-button	*Lachnocaulon beyrichianum*	SC	Known
	Boykin's lobelia	*Lobelia boykinii*	SC	Known
	Carolina bogmint	*Macbridea caroliniana*	SC	Known
	Savannah or Piedmont cowbane	*Oxypolis ternata*	SC	Known
	False coco	*Pteroglossaspis ecristata*	SC	Known
	Awned meadowbeauty	*Rhexia aristosa*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	Henslow's sparrow	*Ammodramus henslowii*	SC	Known
	Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible

	Painted bunting	*Passerina ciris ciris*	SC	Possible
York				
	Bald eagle	*Haliaeetus leucocephalus*	T	Known
	Little amphianthus	*Amphianthus pusillus*	T	Known
	Schweinitz' sunflower	*Helianthus schweinitzii*	E	Known
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T	Possible
	Georgia aster	*Aster georgianus*	C	Known
	Shoals spider-lily	*Hymenocallis coronaria*	SC	Known
	Creeping St. John's wort	*Hypericum adpressum*	SC	Known
	Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC	Possible
York cont.				
	Sun-facing coneflower	*Rudbeckia heliopsidis*	SC	Known
	Biltmore greenbrier	*Smilax biltmoreana*	SC	Known
	Auriculate false foxglove	*Tomanthera auriculata*	SC	Known
	Bachman's sparrow	*Aimophia aestivalis*	SC	Known
	American kestrel	*Falco sparverius*	SC	Possible
	Loggerhead shrike	*Lanius ludovicianus*	SC	Possible
	Carolina darter	*Etheostoma collis*	SC	Known

APPENDIX D
CONSULTATIVE LETTERS FOR POINSETT AND DARE COUNTY RANGES

DEPARTMENT OF THE AIR FORCE
DETACHMENT 5, AIR FORCE RESEARCH LABORATORY (AFMC)
BROOKS AIR FORCE BASE, TEXAS 78235-5118

14 January 2002

MEMORANDUM FOR 20 OSS/OSTRG
ATTENTION: MR. JOHN BRADY
438 KILLIEN AVENUE
SHAW AFB, SC 29152

FROM: AFRL/HEDO
8111 18th Street
Brooks AFB TX 78235

SUBJECT: Consultative Letter, AFRL-HE-BR-CL-2001-0029, Poinsett Weapons Range Laser Safety Survey, Shaw AFB South Carolina

1. Introduction:

1.1. Purpose: To provide certification (IAW AFI 13-212 and AFOSH 48-139) for the safe use of laser systems, as listed in this report, at the Poinsett Range.

1.2. Background: Due to the increased use of new and existing laser systems and evolving laser safety standards, the Air Force is evaluating hazards associated with laser use. This memorandum is in response to a HQ ANG/C4R request. Poinsett Range is routinely used for combat training. Training sorties may include use of aircraft-mounted laser (designator) systems as well as man-transportable laser (illuminator/designator) systems as listed in this report.

1.3. Scope: The on-site survey of the Poinsett Range was performed during 25 September 2001. This survey showed that the range is acceptable for air-to-ground laser operations (combat and training modes) as well as ground-to-ground laser operations. Laser systems have been identified, limitations on flight profiles have been established, and potential Laser Target Areas (LTAs) and ground-based Firing Positions (FPs) are identified. Laser Surface Danger Zones (LSDZs) have also been established for Poinsett Range.

1.4. Description: The Poinsett Electronic Combat Range complex is located 7 miles south of Shaw AFB near Wedgefield, SC. The range consists of bombing/gunnery complex referred to as Poinsett Weapons Range and an Electronic Combat (EC) complex referred to as Poinsett ECR. Poinsett Weapons Range is a night-capable class A conventional range that encompasses 12,520 acres of which 427 acres are actual target areas. The range consists of a Northern Target Array and a Southern Target Array. At the request of the Range Operations Officer, the Northern Target Array was evaluated for man-transportable lasers only, while the Southern Target Array was evaluated for aircraft-mounted lasers only.

2. Evaluation Personnel:

Wallace Mitchell, Optical Engineer, AFRL/HEDO (Northrop Grumman), DSN 240-3718

3. Personnel Contacted:

John Brady, Range Operations Officer, 20 OSS/OSTRG, DSN 965-2597

4. Evaluation:

4.1. Laser Systems: The aircraft-mounted and man-transportable laser systems listed in Table 1, which have been evaluated and approved by the DoD Laser System Safety Review Board (LSSRB), were evaluated for use at Poinsett Range. Note that the AN/AAQ-28 and AN/AAQ-14 laser systems have "eye-safe" training modes. Each laser system was evaluated to assess the hazard potential by determining appropriate Nominal Ocular Hazard Distances (NOHDs), Optical Density (OD) requirements and diffuse reflection hazards in accordance with AFOSH 48-139 and ANSI Z136.1. Guidance was also provided from MIL-HDBK-828A. Table 1 lists all of the relevant parameters (note that N/A means Not Applicable) of the approved systems.

Table 1. NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated and Approved by the DoD LSRB.

Device/Mounting		NOHD		NOHD-O			Buffer Zone (Buffer Angle) each side			Required Eye Protection		
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	nm	kilometers		kilometers			milliradians					
*****MAN TRANSPORTABLE*****												
AN/GAQ-T1 (LD82LB LDSS)	1064	12.5	-	38	43	52	5	N/A	Yes	4.6	5.5	-
AN/GVS-5 (Handheld)	1064	-	2.7	13	21	27	10	N/A	5	3.7	4.4	-
Red filter (19dB)	1064	-	0.29	1.8	1.8	-	10	N/A	-	-	-	-
Yellow filter (29dB)	1064	-	0.056	0.55	0.55	-	10	N/A	-	-	-	-
AN/PAQ-1 (LWLD) (Handheld LTD)	1064	7	3.5	15	33	43	10	N/A	4	4.2	5.8	-
AN/PAQ-3 (MULE) (Tripod)	1064								5	3.9	5.6	-
Designator – day		20	12	53	64	78	2	N/A				
Designator – night		20	12	53	64	78	5	N/A				
Rangefinder – day	1064	12	12	37	47	60	2	N/A	-	-	-	-
Rangefinder – night		12	12	37	47	60	5	N/A				
Rangefinder w/ 12dB filter	1064	3.3	3.3	16	25	31	2	N/A	-	-	-	-
AN/PAQ-3 (MULE) (Handheld)	1064								5	3.9	5.6	-
Designator – day		20	12	53	64	78	10	N/A				
Designator – night		20	12	53	64	78	15	N/A				
Rangefinder – day	1064	12	12	37	47	60	10	N/A	-	-	-	-
Rangefinder – night		12	12	37	47	60	15	N/A				
AN/PAQ-4,A,B,C (IR aiming light)	830	0	-	0	0	0	0	N/A	-	0	0	-
AN/PEQ-1 (SOFLAM)	1064	9.6	-	35	45	54	10	N/A	5	4.0	5.3	-
AN/PEQ-2 (ITPIAL) Aiming light & Illuminator	850	0.263	-	1.8	2.8	4.7	10	N/A	-	2.0	2.0	-

Laser Systems (cont.)

Table 1 (cont.) NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated and Approved by the DoD LSRB.

Device/Mounting		NOHD		NOHD-O			Buffer Zone (Buffer Angle) each side			Required Eye Protection		
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	nm	kilometers		kilometers			milliradians					
******MAN TRANSPORTABLE (cont.)******												
AN/PVS-6 (MELIOS)	1540	0	-	0.007	0.019	0.037	0	0	-	0	0	-
AN/PVS-X (MLRF)	1064	-	3	16	29	41	90 degrees - 3		Yes	3.7	3.7	-
AN/TVQ-2 (GVLLD) (Tripod)	1064								Yes	3.8	5.5	-
Designator		25	17	63	80	87	2	N/A				
Rangefinder w/ no filter		8	8	28.5	40	65	2	N/A				
Rangefinder w/ 8.5dB yellow filter		3.1	3.1	15	23	39	2	N/A				
CLD (compact laser designator)	1064	9.7	-	38	48	58	10	N/A	5	4.5	5.4	-
LLTD (laser light target designator)	1064	7	-	15	38	42	10	N/A	-	4.0	4.9	-
******AIRCRAFT MOUNTED******												
AN/AAQ-28 LITENING II												
Training Mode	N/A	0	0	0	0	0	N/A	N/A	N/A	0	0	0
Designator	1064	11	N/A	38	48	57	N/A	2	N/A	4.0	5.3	N/A
Marker	808	0.18	N/A	1.3	2	2.9	N/A	2	N/A	2.5	2.8	N/A
Night Targeting System - NTS (AH-1W)	1064	15	9.2	48	59	69	5	5	Yes	3.5	5.2	-
AN/AAS-33A TRAM (A-6E)	1064	14.6	9	47	58	67	N/A	5	-	4.6	5.8	3.0
AN/AAS-37 (OV-10D NOS)	1064	11.2	7.1	45	56	59	N/A	5	-	4.6	5.6	3.0
AN/AAS-38 & 38A (F/A-18A-F)	1064	17	10	50	63	73	N/A	5	-	4.3	5.4	3.0
AN/ASQ-153 PAVE SPIKE (F-4E)	1064	10	6.8	33	48	58	N/A	5	-	4.2	5.6	-
AN/AVQ-25 PAVE TACK (F-111F)	1064	16	8.8	48	52	70	N/A	5	-	4.3	5.8	-
IRADS (F-117A)	1064	14	7.5	45	56	65	N/A	2	N/A	4.5	6.0	N/A
LAAT (AH-1S & F)	1064	5	3.4	15	30	36	5	5	Yes	3.5	4.8	-
AN/AAQ-14 LANTIRN												
Combat Mode	1064	15	9	48	59	69	N/A	5[1]	N/A	4.5	5.6	N/A
Training Mode	1540	0	0	0.18	0.32	0.58	0	N/A	N/A	0	1.2[3]	N/A
Secondary Beam[2]	1064	0.35	0.35	2.4	3.8	5.44	N/A	N/A	N/A	1.1	2.0	N/A
MMS-C (OH-58D)	1064								-	4.1	5.3	-
Single pulse		-	23	56	72	85	5	5				
Multi-pulse		35	-	76	98	119	5	5				
NITE EAGLE (UH-1N)	1064	15	11	45	55	65	5	5	-	4.1	5.2	3.7
PAVE SPECTRE	1064	7.1	4.5	29	38	46	N/A	5	N/A	3.7	5.4	-
TADS (AH-64)	1064	26	16	45	68	71	5	5	Yes	4.0	5.5	-
AN/AAQ-22 NTTS (UH-1N)	1064	-	0.72	4	6.1	8.6	5	5	N/A	4.0	4.0	-
AC-130U LTD/RF									-			-
Combat mode	1064	44	-	90	110	120	N/A	5		3.2	4.8	
Training mode	1064	2.9		16	22	28	N/A	5		1.2	2.9	
AC-130U LIA	807	0.10	-	0.67	1.10	1.60	N/A	5	-	3.2	4.7	-
Magic Lantern (ML) (SH-2F/MH-53-E)	532	0.15	-	1.1	1.7	2.6	5	5	-	5.2	6.7	-

1. **Air Force assigned buffer zone is 2 milliradians for LANTIRN.** Navy F-14 LANTIRN and general policy is that aircraft be assigned a minimum buffer zone of 5 milliradians.
2. Air Force policy is to maintain aircraft separation of 1000 ft. Navy prohibits tandem or buddy aircraft lasing.
3. For F-15/16 this OD is 0, for the F-14 the OD used is 1.2.

Table 1 (cont.) NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated and Approved by the DoD LSRB.												
Device/Mounting		NOHD		NOHD-O			Buffer Zone (Buffer Angle) each side			Required Eye Protection		
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	nm	kilometers		kilometers			milliradians					
COMMERCIAL OFF THE SHELF (COTS) MILITARY LASER SYSTEMS**												
*****MAN TRANSPORTABLE*****												
AIM-1/D	800-850	0.075	-	0.46	-	-	10	10	-	1.7	1.7	-
AIM-1/DLR	800-850	0.236	-	1.56	2.43	3.55	10	10	-	1.7	1.7	-
LPL-30	800-850	0.09	-	0.68	1.1	1.6	10	10	-	1.7	1.7	-
M-931	850	0.011	-	0.16	0.28	0.4	10	10	-	0.7	0.8	-
GCP-1/1A GCP-1B	800-850	0.09 0.24	-	0.68 1.65	1.1 2.57	1.6 3.75	10 10	10 10	-	1.7 2.2	1.7 2.2	-
NITE EYE	980	0.09	-	0.68	1.1	1.6	10	10	-	1.7	1.7	-
HAVIS (M16 Aiming light)	850	0.012	-	0.1	0.17	0.25	10	10	-	1.1	1.1	-
IZLID II	870	0.248	-	1.63	2.55	4.28	10	10	-	3.0	3.0	-
TD-100 TD-100A	850 632.8 850 670	0.1	-	-	-	-	10	10	-	1.1 0.3 1.1 0.6	1.1 0.3 1.1 0.6	-
*****AIRCRAFT MOUNTED*****												
AIM-1/MLR	800-850	0.085	-	0.68	1.1	1.6	5	5	-	1.7	1.7	-
AIM-1/EXL	800-850	0.130	-	0.68	1.1	1.6	5	5	-	1.7	1.7	-

* Assume that built-in safety filter only protects against the wavelength of the laser in which it is installed and that it does not always protect against other laser wavelengths.
** WARNING! THIS HAZARD DATA COULD CHANGE SINCE DOD HAS NO CONTROL OVER MANUFACTURING OF THESE PRODUCTS. HAZARD CHARACTERISTICS IN THIS TABLE ARE VALID AS OF THE DATE OF DOD EVALUATION; PERIODICALLY CHECK WITH THE MANUFACTURER TO ENSURE THAT CHARACTERISTICS HAVE NOT CHANGED SINCE THE DATE OF THE LAST DOD EVALUATION.

4.2. Laser Hazard Zone: This is defined as the airspace within which a laser hazard exists to personnel intentionally or accidentally exposed to laser emission. This should be considered an "eye-hazard" space for the laser system. Personnel within this Laser Hazard Zone must wear Laser Eye Protection (LEP) to prevent laser eye damage. The Laser Hazard Zone extends from the laser output aperture to the NOHD for the viewing conditions considered (i.e., unaided viewing, 7x50 binocular viewing, etc.).

4.2.1 Laser Surface Danger Zone (LSDZ): This is defined as the ground area that intersects the Laser Hazard Zone. The LSDZ should be considered an "eye-hazard" zone for the laser system. Ground personnel within the LSDZ must wear LEP to prevent laser eye damage.

4.2.2 Factors Affecting Laser Accuracy. Several factors limit the laser system's ability to precisely place the laser on target. They together determine the extent of the Laser Hazard Zone associated with the laser's use. The following values will be required in order to establish accurate Laser Hazard Zones.

4.2.2.1 Beam Divergence: The laser beam expands as it propagates away from the exit aperture on the targeting pod.

4.2.2.2 Boresight Error: Due to engineering limitations in precisely aligning the laser with the IR image in the targeting pod FLIR, the laser may not always be shooting at the exact center of the display crosshairs.

4.2.2.3 Tracking Error: There is a limit in how accurately the IR system tracking software can maintain track of the target assuming a stable Point Track or Area Track with no operator inputs.

4.2.2.4 Combined Error: The combined boresight and tracking error introduce a ranked set sampling (RSS) error from the center of the crosshairs to the center of the laser beam.

4.2.3. Buffer Angles (Pointing Accuracy): The MIL-HDBK-828A procedure is to use 5 times the combined error for similar type systems and use this value for a "buffer-angle" in hazard zone calculations. This combined buffer will determine a "Laser Hazard Zone (LHZ)" and "Laser Surface Danger Zone (LSDZ)". All laser system buffer angles are listed in Table 1.

4.3. Laser Footprints: The underlying concept of laser range safety is to prevent exposure of unprotected personnel to laser radiation in excess of the Maximum Permissible Exposure (MPE). This is accomplished by determining where the laser radiation is expected to be, restricting access of unprotected personnel, and removing reflective surfaces from the area. By determining where the laser radiation is expected to be, a laser footprint is created. A laser footprint is the projection of the laser beam and buffer zone on the ground or target area. The laser footprint may be part of the LSDZ if that footprint lies within the NOHD of the laser. Laser footprints can be generated through use of the Laser Range Management Software (LRMS), which was developed by AFRL/HEDO and is available at 20 OSS/OSTRG. The following is a general discussion of what parameters to consider when evaluating man-portable or aircraft-mounted laser systems. A more detailed discussion on how to calculate the LSDZ can be found in Appendix D of MIL-HDBK-828A.

4.3.1 Man-Transportable Systems: When evaluating these systems, parameters required include system buffer angle, firing position elevation, target elevation, backstop elevation, firing position-to-target range, and target-to-backstop range. The buffer angles for fielded military systems are included in Table 1. For man-transportable systems not included in this table, contact either the local Base Radiation Safety Officer or our office. Typically, tripod-mounted systems have a 2 or 5 milliradian buffer angle, while hand-held lasers normally require 10 milliradians. One method to calculate the available vertical buffer angle (δ) between laser line-of-sight to target and laser line-of-sight to backstop is to use the following equation from MIL-HDBK-828A Appendix D:

$$\delta = \arctan((bl - h) / (dl + A)) + \arctan((h - al) / (dl)) \quad (1)$$

where:

h = firing position elevation
al = target elevation

bl = backstop elevation
dl = firing position-to-target range
A = target-to-backstop range
Note: For a graphical representation of the above equation, see Figure D-17 in MIL-HDBK-828A.

As long as the angle δ remains greater than the system buffer angle (α), the beam is safely contained vertically and the LSDZ only extends to the backstop. If the angle δ remains less than the system buffer angle (α), the beam is not safely contained and the LSDZ extends beyond the backstop. In this case, the LSDZ extends out to the NOHD of the system if no other structure exists for terminating the beam.

4.3.2 All fielded military man-transportable laser systems were evaluated only for use on Northern Target Array LTAs from the following two firing positions located: Main Tower (FP 1), and Bunker site (FP 2). Attachment 2 represents the associated LSDZs for these specific LTAs.

4.3.2.1 Some laser **illuminators/pointers** such as those from the GCP or IZLID series have a 10 mrad buffer zone, but have a minimal NOHD (< 300 m unaided viewing). Proper training mitigates the hazards associated with these types of devices. Therefore, LSDZs are not required and the devices are approved for all LTAs and from all FPs. Operations personnel should always be aware of system-specific NOHDs and their associated system buffer zones. These can be found in Table 1 of this report or MIL-HDBK-828A.

4.3.2.2 The man-transportable laser systems were approved for the LTA and FP combinations listed below in Tables 2 and 3. Note that some combinations may not be effective due to inadequate line-of-sight between the FP and LTA. Some combinations were not certified due to a small pond in this line-of-sight. Also, keep in mind the target-to-laser safety zone as described in Section 5.2.1.3 of this report when designating from these positions. Lastly, be aware that in most cases, the tree line that surrounds the Northern Target Array is required to terminate the laser beam. Any changes (clear cutting, fire damage, etc.) to the tree line may invalidate the certification listed below. Please contact our office immediately if changes do occur.

Poinsett Range	MAIN TOWER (FP 1)				
	System Buffer Zone				
LASER TARGET AREA (LTA)	**2 mrad**	**5 mrad**	**10 mrad (NOHD ≤ 300 m)**	**10 mrad (NOHD > 300 m)**	**15 mrad**
Conv. Circle	YES	YES	YES	YES	
North TAC	YES		YES		
South TAC			YES		
TAC III	YES		YES		

Table 2. Laser Target Areas that are Certified Safe for Man-Transportable Systems.
YES – Certified for laser use with the specified buffer zone
NO – Not certified for laser use with the specified buffer zone

Poinsett Range	BUNKER SITE (FP 2)				
	System Buffer Zone				
LASER TARGET AREA (LTA)	2 mrad	5 mrad	10 mrad (NOHD ≤ 300 m)	10 mrad (NOHD > 300 m)	15 mrad
Conv. Circle	YES	YES	YES	YES	
North TAC	YES	YES	YES	YES	
South TAC	YES	YES	YES	YES	
TAC III			YES		

Table 3. Laser Target Areas that are Certified Safe for Man-Transportable Systems.
YES – Certified for laser use with the specified buffer zone
NO – Not certified for laser use with the specified buffer zone

4.3.3 Aircraft-Mounted Systems: Aircraft-mounted systems are included on both fixed- and rotary-wing aircraft. Rotary-wing based systems were not evaluated, by request of Range Commander, at Poinsett Range. When evaluating fixed-wing systems, it is important to determine desired flight profiles. Flight information necessary to perform an evaluation includes the aircraft's altitude, slant range-to-target, and directions of the aircraft relative to the target during laser operations. A determination of the maximum allowable footprint must be made. This distance may be defined by simple observation of distance from target to range boundary or manned facility. The projected laser footprint from the aircraft can be determined by using modified equations from MIL-HDBK-828A Appendix D:

$$A = (R^{*}\sin(\alpha)) / [\sin(\arcsin(h/R) - \alpha)] \quad (2)$$

$$B = (R^{*}\sin(\alpha)) / [\sin(\arcsin(h/R) + \alpha)] \quad (3)$$

where:

A = Forward footprint (distance from the target to the forward geometric boundary)
B = Aft footprint (distance from the target to the aft geometric boundary)
R = Slant range from the laser to the target
α = Buffer angle plus half-angle divergence as defined in MIL-HDBK-828A
h = Altitude of the laser above ground level (AGL)

Note: For a graphical representation of the above equation, see Figure D-19 in MIL-HDBK-828A.

For most cases, the largest footprint is made with the longest slant range and lowest lasing altitude combination. By varying the AGL and slant range, the correct combination for a projected footprint that is smaller, or equal, to the maximum allowable footprint can be determined. Once this combination is determined, the corresponding forward (A) and aft (B) values can be used to create the "Limitation on Flight Profile" plots, as shown in Figures 1 and 2, by using the following equations and plotting altitude (h) versus slant range (R):

Forward Footprint $h = R * \sin(\arcsin(((R / A) * \sin(\alpha)) + \alpha))$ (4)

Aft Footprint $h = R * \sin(\arcsin(((R / B) * \sin(\alpha)) - \alpha))$ (5)

4.3.3.1 LANTIRN/LITENING II/IRADS: As listed in MIL-HDBK-828A, the USAF has assigned a 2 mrad buffer zone to the combat modes of the LANTIRN, LITENING II, and IRADS laser systems. To determine the largest LSDZ about any target, we evaluated the following laser weapon delivery profiles for LANTIRN/LITENING II/IRADS-equipped aircraft:

(1) System Level Delivery
(2) Laser Loft
(3) High Altitude
(4) Dive
(5) "Buddy Lasing"

The largest LSDZ occurs at the lowest altitude and longest slant range combination. The dimensions of the largest, certified LSDZ (flat terrain) about a single target result in a laser footprint 2,360 ft. forward of the target, 1,970 ft. aft of the target, and a width of 97 ft. at the target. However, the terrain-obscured footprints that have been developed with LRMS, and shown in Attachment 3, add or subtract up to 1,000 ft. from the forward footprint. These dimensions are only applicable for the Combat Modes of the aircraft-mounted systems listed in Table 1 and are applicable only to the Southern Target Array. See section 4.3.4 for discussion concerning the laser system's training mode.

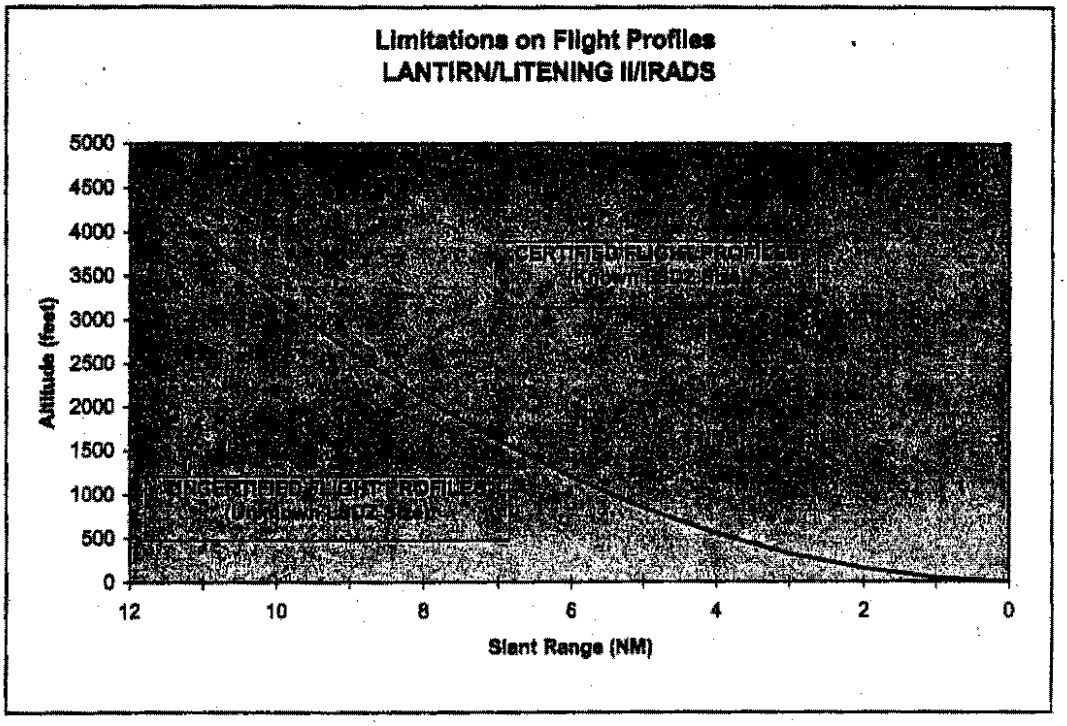


Figure 1. Limitations on Altitude and Slant Range Based upon a Forward Footprint of 2,360 ft (LANTIRN/LITENING II/IRADS)
Note: Unrestricted Laser Headings

SLANT RANGE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)	SLANT RANGE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)
12	4,652	6	1,200
11	3,920	5	843
10	3,251	4	550
9	2,644	3	319
8	2,100	2	150
7	1,619	1	44

Figure 1-a. Limitations on Altitude and Slant Range (LANTIRN/LITENING II/IRADS).
Note: Unrestricted Laser Headings

4.3.3.2 OTHER Systems: As listed in MIL-HDBK-828A, a 5 mrad buffer angle is given for all **other** aircraft-mounted systems (AN/AAS-38 & 38A on F/A-18A-f, etc.) currently in use. To determine the largest LSDZ about any target, we evaluated the following laser weapon delivery profiles for aircraft equipped with other laser systems:

(1) System Level Delivery
(2) Laser Loft
(3) High Altitude
(4) Dive
(5) "Buddy Lasing"

To produce a laser footprint equal to that of the previous example (4.3.3.1), the flight profile (altitude and slant range of the aircraft) must be adjusted accordingly. The impact of a larger buffer angle is clear to see in Figure 2. This profile and associated footprint dimensions are applicable to the OTHER systems specified above and to the LTAs that have been identified as heavyweight targets. The actual Poinsett Range LSDZs, shown for these LTAs and available laser headings, are also provided in Attachment 3.

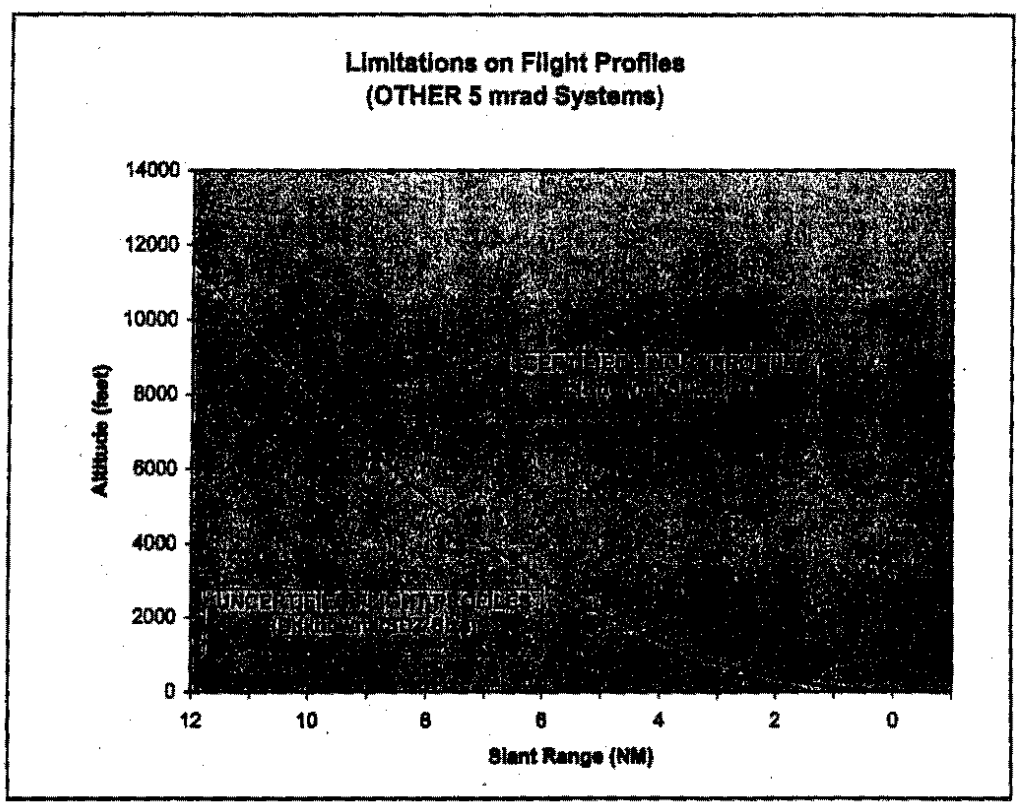


Figure 2: Limitations on Altitude and Slant Range Based Upon a Forward Footprint of 2,360 ft (OTHER 5 mrad systems)
Note: Unrestricted Laser Headings.

SLANT DISTANCE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)	SLANT DISTANCE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)
12	11,628	6	3,000
11	9,800	5	2,108
10	8,126	4	1,373
9	6,609	3	800
8	5,249	2	374
7	4,046	1	109

Figure 2-a. Limitations on Altitude and Slant Range (OTHER 5 mrad systems).

4.3.4 Laser System Training Mode: Both the AN/AAQ-14 LANTIRN and AN/AAQ-28 LITENING II targeting pods have the capability to operate in a Training Mode. This eye-safe training capability allows pilots to simulate weapons deliveries. While both systems are able to accurately calculate target range, providing eye-safe ranging over all areas, the AN/AAQ-14 LANTIRN accomplishes this by lasing at a wavelength (1540 nm) that is not harmful to the eye while the AN/AAQ-28 LITENING II is able to accomplish this without firing the laser.

4.3.4.1 While the AN/AAQ-14 and AN/AAQ-28 systems are in Training Mode, all Poinsett Range LTAs are certified safe-to-use without restriction.

4.3.5 Table 4 lists the allowable LTAs, aircraft-mounted system, and available laser headings certified for use on Poinsett Range. These available laser headings are applicable to all tactical laser delivery profiles listed previously, but may be further restricted by the local Range Authority. Attachment 3 represents the associated LSDZ for Poinsett Range. LSDZs are not required for the Training Mode of the laser systems listed in Table 1 since they are eye-safe.

POINSETT RANGE	LANTIRN and LITENING II (Training Mode)	LANTIRN and LITENING II (Combat Mode - 2 mrad), and IRADS	OTHER (Combat Mode - 5 mrad)
Laser Target Area (LTA)	Certified Use and Available Laser Headings	Certified Use and Available Laser Headings	Certified Use and Available Laser Headings
101	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°
102	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°
103	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°
104	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°
105	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°
106	YES; 000° to 360°	YES; 000° to 360°	YES; 000° to 360°

Table 4. Certified Laser Target Areas (LTAs) and Available Laser Headings for Specified Laser Systems
YES - Certified for use with the specified laser system
NO - Not certified for use with the specified laser system

5. Conclusions and Recommendations:

5.1. The Poinsett Range has a laser safety program that is in compliance with AFOSH 48-139 and AFI 13-212. Range safety instructions are currently provided in AFI 13-212, Volume 1/SAFB SUP1, dated 4 October 2000. Future Range Regulations shall incorporate guidance provided in this report. The laser systems listed in Table 1 are certified for use within the Poinsett Range provided that the guidelines provided in this consultative letter are observed. Specific guidelines include the following:

5.1.1 The laser systems are used only against the LTA's listed in this report.

5.1.2 All aircraft-mounted laser operations commence and end within the confines of restricted airspace for the range.

5.1.3 All laser operators meet the following minimum criteria:

5.1.3.1 Have received appropriate laser range briefing by the training Laser Safety

Officer (LSO) or other approved qualified personnel.

5.1.3.2 Have received training in the proper and safe use of the laser systems employed.

5.1.3.3 Have positive communication with the Range RCO/LSO during laser operations.

5.1.4 Fire aircraft-mounted lasers only after positive identification of the target and after ensuring that the LTA and the LSDZ are clear of unauthorized personnel.

5.1.5 The Range RCO/LSO shall take the LSDZ into consideration when planning any laser operation activity.

5.1.6 Warn all personnel on the range of imminent laser operations.

5.1.7 Prior to air-to-ground laser operation, pilots should make a cold (non-lasing) pass, if possible, to ensure that the LTA and corresponding LSDZ are clear of unauthorized personnel.

5.1.8 Ensure that all personnel in the vicinity of Poinsett Range remain outside the LTA and LSDZ during laser operations or wear appropriate laser eye protection (LEP) corresponding to the wavelength and optical density listed in Table 1.

5.1.9 Poinsett Range personnel use old, military vehicles as laser targets. For air-to-ground lasing operations, the entire LSDZ shall be cleared of specular reflectors. Any painted object should be periodically examined for flaking or wear of the paint.

5.1.10 Laser warning signs shall be posted, at a minimum, to the range main access areas during laser operations. Periodic checks and replacement of all laser-warning signs should be part of the LSO's preventive maintenance schedule.

5.1.11 Laser operations must be immediately stopped if unauthorized personnel are observed in the LSDZ, equipment malfunction is observed, target is lost in field of view, or anytime laser safety cannot be assured. Essential personnel in the LSDZ shall wear appropriate LEP corresponding to the wavelength and optical density listed in Table 1.

5.1.12 No Class 3b or 4 lasers shall be fired above the horizon or backstop (i.e., hills, trees, or large targets) without prior coordination with NORAD and the FAA. NORAD POC: Orbital Safety Officer, FAX: (719) 474-3604, Voice: (719) 474-4496, DSN: 268-3604 or 268-4496. FAA POC: Contact the FAA Regional Office for further information.

5.1.13 Keep a record showing the date for each laser mission.

5.1.14 Since water can become a flat specular reflector when it is calm (i.e., mirror-like surface), the reflection hazard to personnel in other aircraft increases and additional precautions

are required. The decision to use a target for lasing when calm, standing water is present should be made by the RCO/LSO.

5.1.15 For suspected laser eye injuries, follow the guidance IAW AFOSH 48-139 and complete the Laser Radiation Injury Checklist provided in Attachment 4.

5.2. The following is a general discussion of some specific laser hazards associated with mission tactics that a Range LSO should be aware of and address in laser safety instructions, if necessary.

5.2.1 There are several aircraft laser scenarios that have tactics that result in aircraft headings that are different from the laser heading. The LSDZs are based on the heading of the laser and not on the heading of the aircraft. When a laser mission is planned, it is important to use the appropriate laser safety profile for determining the laser hazard zone.

5.2.1.1 In some exercises, the laser is fired from at least two discrete points. The first time the laser is used, it is used for ranging type operations. At this point it is generally aimed at the target on the same heading as the aircraft and is turned off prior to releasing the ordnance. However, after the aircraft has released its ordnance and turned away (approximately 90 degrees), the laser may be re-energized in order to guide the bomb to the target. This creates a problem from a laser safety perspective in that the LSDZ is dramatically different when the laser is fired the second time because it is firing from a different heading. In order to perform this type of exercise, the LSDZ for the target and target area has to be calculated for a full 360-degree range of laser headings. If the laser safety profile is only for a specific heading, then it is not possible to perform these types of exercises at that target.

5.2.1.2 Another type of aircraft tactic, called Continuously Computing Impact Position (CCIP), is where the pilot turns the laser on well short of the target and lases the ground prior to the target. This type of operation poses a problem for point targets or targets at the edge of the target area as any LSDZs are invalid if the laser operator is aiming the laser outside the LTA. The LSDZs calculated in this report generally encompass target areas. However, in order to maintain the safety parameters established by these LSDZs, it is important that the laser only be turned on while it is aiming at the LTA. If the target being lased is a point target or has only a small LTA, CCIP-type missions should not be permitted.

5.2.1.3 When man-transportable, rotary-wing, or wingman-aircraft (buddy lasing) based laser systems are designating for another aircraft carrying the laser guided weapon, there are important safety patterns to consider. The reason for this is that with certain types of aircraft laser targeting systems, there is a chance that the targeting system will false-lock on the laser position because it sees the laser source before it sees the target. Designator profiles behind the weapon launch platforms are the safest, but if that is not possible a profile should be selected that keeps the designator out of the laser guided weapon's field of view (FOV). The proper exclusionary zone varies from system to system. The Joint Close Air Support Manual 3-09.3 requires a 20 degree safety zone extending from the target back to the laser designator firing position. The aircraft with the laser-guided weapon should avoid approaching along this 20-degree range of headings. However, if that is unavoidable, the pilot should offset the heading ten

(10) degrees right or left to preserve safety standards.

6. Summary:

20 OSS/OSTRG has a laser safety program that is in compliance with AFI 13-212 and AFOSH 48-139. The man-transportable laser systems listed in Table 1 are certified for use on specific targets within the Poinsett Range Northern Target Array provided that the guidelines provided in this consultative letter are observed. The AN/AAQ-14 LANTIRN and AN/AAQ-28 LITENING II targeting pods (Training Mode only) listed in Table 1 are certified for use on all targets within the Poinsett Range Southern Target Array without restriction. The aircraft-mounted (Combat Mode) laser systems listed in Table 1 are certified for use on specific targets within the Poinsett Range Southern Target Array provided that the guidelines provided in this consultative letter are observed. This report documents AFRL/HEDO certification for laser operations (in accordance with contained guidance) on Poinsett Range. This certification is valid for up to three years. The local Range Operating Authority must also provide authorization before any laser operations may commence.

NOTE: The flight profiles discussed in this report are not to be construed as mandated aircraft flight paths but as boundary limits at a given location that distinguish between safe and unsafe laser use. This evaluation addresses only those systems approved for general training scenarios. A separate evaluation should be done on a case-by-case basis by the training facility Laser Safety Officer (LSO), qualified Bioenvironmental Engineer/Health Physicist, or AFRL/HEDO on laser systems used in nontraditional modes, R&D applications, and prototype systems. Force-on-force scenarios are not evaluated in this report and should only be allowed with the express consent of the training facility LSO using safety parameters established by the LSO and the qualified personnel mentioned above on a case-by-case basis.

7. Please contact the Optical Radiation Safety Team at DSN 240-3718 or 800-473-3549 if you have any questions concerning this report.

//s//
WILLIAM P. ROACH, Lt Col, USAF, BSC
Chief, Optical Radiation Branch

Attachments:
1. Poinsett Range Manned Positions and Laser Target Areas
2. Poinsett Range Man-Transportable Systems Laser Surface Danger Zones
3. Poinsett Range Aircraft-Mounted Systems Laser Surface Danger Zones
4. Laser Radiation Injury Checklist

Cc:
HQ ACC/DORR
20 AMDS/SGPB

Pages 15-32 consist of figures + checklist.
electronic copy is available.

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY (AFMC)
BROOKS AIR FORCE BASE, TEXAS 78235-5214

19 November 2002

MEMORANDUM FOR AIR FORCE DARE RANGE
P. O. BOX 40
MANTEO, NC 27954
ATTN: BARRY D. BEATTY

FROM: AFRL/HEDO
2650 LOUIS BAUER DRIVE
BROOKS AFB TX 78235-5214

SUBJECT: Consultative Letter, AFRL-HE-BR-CL-2002-0033, USAF Dare County Range Laser Safety Evaluation, Seymour-Johnson AFB, NC.

1. Introduction:

1.1. Purpose: To provide certification (IAW AFI 13-212 and AFOSH 48-139) for the safe use of laser systems, as listed in this report, at the Dare County Range.

1.2. Background: Due to the increased use of new and existing laser systems and evolving laser safety standards, the Air Force is evaluating hazards associated with laser use. This memorandum is in response to a HQ ACC/DORR request. Dare County Range is routinely used for combat training. Training sorties may include use of aircraft-mounted laser (designator) systems as well as man-transportable laser (illuminator/designator) systems as listed in this report.

1.3. Scope: The on-site survey of the Dare County Range was performed during 11 June 2002. This survey showed that the range is acceptable for air-to-ground laser operations (combat and training modes) as well as ground-to-ground laser operations. Laser systems have been identified, limitations on flight profiles have been established, and potential Laser Target Areas (LTAs) and ground-based Firing Positions (FPs) are identified. Laser Surface Danger Zones (LSDZs) have also been established for Dare County Range. FPs and LTAs are depicted in Attachment 1.

1.4. Description: The Dare County Bombing and Electronic Combat Range (DCBECR) is a joint Air Force/Navy Weapons Range, with the Air Force being the host, located in northeastern North Carolina on a peninsula bounded by waters of the Alligator River, Albemarle Sound, and Pamlico Sound. The range is constructed on swampy, wooded land that is predominately peat bog. The range is divided so that Air Force DCBECR utilizes the airspace in the south and Navy DCBECR utilizes the airspace in the north. Dare County Range is a three-tower, class-A range. The range contains a nuclear target, a conventional target, heavyweight ordnance targets, multiple tactical targets, laser targets, and a strafe pit dispersed throughout the range complex. The tactical targets include 4 specialized active infrared targets. The west conventional and nuclear targets are equipped with lights for night deliveries. Detailed range layout is shown in Attachment 1.

2. Evaluation Personnel:

Dan Seaman, Electro-Optic Engineer, AFRL/HEDO (Northrup Grumman), DSN 240-3265

3. Personnel Contacted:

Randy Jernigan, TSgt 4 OSS/OL-A
Barry Beatty, Range Manager GS-12, 4 OSS/OSO

4. Evaluation:

4.1. Laser Systems: The aircraft-mounted and man-transportable laser systems listed in Table 1, which have been evaluated by an approved military agency, were evaluated for use at Dare County Range. Note that the AN/AAQ-28 LITENING II and AN/AAQ-14 LANTIRN laser systems have "eye-safe" training modes. Each laser system was evaluated to assess the hazard potential by determining appropriate Nominal Ocular Hazard Distances (NOHDs), Optical Density (OD) requirements and diffuse reflection hazards in accordance with AFOSH 48-139 and ANSI Z136.1. Guidance was also provided from MIL-HDBK-828A.

Table 1. NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated by an Approved Military Service Agency.

Device/Mounting		NOHD		NOHD-O			Buffer Zone (Buffer Angle) each side			Required Eye Protection		
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	Nm	kilometers		kilometers			milliradians					
*****MAN TRANSPORTABLE*****												
AN/GAQ-T1 (LD82LB LDSS)	1064	12.5	-	38	43	52	5	N/A	Yes	4.6	5.5	-
AN/GVS-5 (Handheld)	1064	-	2.7	13	21	27	10	N/A	5	3.7	4.4	-
Red filter (19dB)	1064	-	0.29	1.8	1.8	-	10	N/A	-	-	-	-
Yellow filter (29dB)	1064	-	0.056	0.55	0.55	-	10	N/A	-	-	-	-
AN/PAQ-1 (LWLD) (Handheld LTD)	1064	7	3.5	15	33	43	10	N/A	4	4.2	5.8	-
AN/PAQ-3 (MULE) (Tripod)	1064								5	3.9	5.6	-
Designator – day		20	12	53	64	78	2	N/A				
Designator – night		20	12	53	64	78	5	N/A				
Rangefinder – day	1064	12	12	37	47	60	2	N/A	-	-	-	-
Rangefinder – night		12	12	37	47	60	5	N/A				
Rangefinder w/ 12dB filter	1064	3.3	3.3	16	25	31	2	N/A	-	-	-	-
AN/PAQ-3 (MULE) (Handheld)	1064								5	3.9	5.6	-
Designator – day		20	12	53	64	78	10	N/A				
Designator – night		20	12	53	64	78	15	N/A				
Rangefinder – day	1064	12	12	37	47	60	10	N/A	-	-	-	-
Rangefinder – night		12	12	37	47	60	15	N/A				
AN/PAQ-4,A,B,C (IR aiming light)	830	0	-	0	0	0	0	N/A	-	0	0	-
AN/PEQ-1 (SOFLAM)	1064	9.6	-	35	45	54	10	N/A	5	4.0	5.3	-
AN/PEQ-2 (ITPIAL) Aiming light & Illuminator	850	0.263	-	1.8	2.8	4.7	10	N/A	-	2.0	2.0	-
AN/PVS-6 (MELIOS)	1540	0	-	0.007	0.019	0.037	0	0	-	0	0	-
AN/TVQ-2 (GVLLD) (Tripod)	1064								Yes	3.8	5.5	-
Designator		25	17	63	80	87	2	N/A				
Rangefinder w/ no filter		8	8	28.5	40	65	2	N/A				
Rangefinder w/ 8.5dB yellow filter		3.1	3.1	15	23	39	2	N/A				
CLD (compact laser designator)	1064	9.7	-	38	48	58	10	N/A	5	4.5	5.4	-
LLTD (laser light target designator)	1064	7	-	15	38	42	10	N/A	-	4.0	4.9	-
LF28A (UK) (Handheld)	1064	1.9	-	9.4	13.9	18.9	10	N/A	N/A	4.0	5.03	-
LF28A (UK) (Tripod)	1064	1.9	-	9.4	13.9	18.9	5	N/A	N/A	4.0	5.03	

Laser Systems (cont.)

Table 1. (cont.) NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated by an Approved Military Service Agency.												
Device/Mounting		NOHD		NOHD-O			Buffer Zone (Buffer Angle) each side			Required Eye Protection		
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	nm	kilometers		kilometers			milliradians					
*****AIRCRAFT MOUNTED*****												
AN/AAQ-28 LITENING II Training Mode Designator Marker	N/A 1064 808	0 11 0.18	0 N/A N/A	0 38 1.3	0 48 2	0 57 2.9	N/A N/A N/A	N/A 2 2	N/A N/A N/A	0 4.0 2.5	0 5.3 2.8	0 N/A N/A
AN/AAS-37 (OV-10D NOS)	1064	11.2	7.1	45	56	59	N/A	5	-	4.6	5.6	3.0
AN/AAS-38 & 38A (F/A-18A-F)	1064	17	10	50	63	73	N/A	5	-	4.3	5.4	3.0
AN/ASQ-153 PAVE SPIKE (F-4E)	1064	10	6.8	33	48	58	N/A	5	-	4.2	5.6	-
AN/AVQ-25 PAVE TACK (F-111F)	1064	16	8.8	48	52	70	N/A	5	-	4.3	5.8	-
IRADS (F-117A)	1064	14	7.5	45	56	65	N/A	2	N/A	4.5	6.0	N/A
AN/AAQ-14 LANTIRN Combat Mode Training Mode Secondary Beam[2]	1064 1540 1064	15 0 0.35	9 0 0.35	48 0.18 2.4	59 0.32 3.8	69 0.58 5.44	N/A 0 N/A	5[1] N/A N/A	N/A N/A N/A	4.5 0 1.1	5.6 1.2[3] 2.0	N/A N/A N/A
PAVE SPECTRE	1064	7.1	4.5	29	38	46	N/A	5	N/A	3.7	5.4	-
AC-130U LTD/RF Combat mode Training mode	1064 1064	44 2.9	-	90 16	110 22	120 28	N/A N/A	5 5	-	3.2 1.2	4.8 2.9	-
AC-130U LIA	807	0.10	-	0.67	1.10	1.60	N/A	5	-	3.2	4.7	-
TIALD (UK Harrier, Jaguar, Tornado)	1064	11.7	-	40.5	52.0	63.2	N/A	5	N/A	4.7	5.28	-
COMMERCIAL OFF THE SHELF (COTS) MILITARY LASER SYSTEMS**												
*****MAN TRANSPORTABLE*****												
AIM-1/D	800-850	0.075	-	0.46	-	-	10	10	-	1.7	1.7	-
AIM-1/DLR	800-850	0.236	-	1.56	2.43	3.55	10	10	-	1.7	1.7	-
LPL-30	800-850	0.09	-	0.68	1.1	1.6	10	10	-	1.7	1.7	-
M-931	850	0.011	-	0.16	0.28	0.4	10	10	-	0.7	0.8	-
GCP-1/1A GCP-1B	800-850	0.09 0.24	-	0.68 1.65	1.1 2.57	1.6 3.75	10 10	10 10	-	1.7 2.2	1.7 2.2	-

1. Air Force assigned buffer zone is 2 milliradians for LANTIRN. Navy F-14 LANTIRN and general policy is that aircraft be assigned a minimum buffer zone of 5 milliradians.
2. Air Force policy is to maintain aircraft separation of 1000 ft. Navy prohibits tandem or buddy aircraft lasing.
3. For F-15/16 this OD is 0, for the F-14 the OD used is 1.2.

Table 1. (cont.) NOHD (Atmospheric Attenuated), Range Safety Information, and Eye Protection Requirements for Fielded Military Laser Systems Evaluated by an Approved Military Service Agency.												
							Buffer Zone					
Device/Mounting		NOHD		NOHD-O			(Buffer Angle)			Required Eye Protection		
							each side					
	wave-length	multi-pulse	single pulse	7x50 binoc	8-cm optics	12-cm optics	static	moving	built-in* safety filters OD	unaided OD	aided OD	single pulse OD
	nm	kilometers		kilometers			milliradians					
COMMERCIAL OFF THE SHELF (COTS) MILITARY LASER SYSTEMS**												
*****MAN TRANSPORTABLE*****												
NITE EYE	980	0.09	-	0.68	1.1	1.6	10	10	-	1.7	1.7	-
HAVIS (M16 Aiming light)	850	0.012	-	0.1	0.17	0.25	10	10	-	1.1	1.1	-
IZLID II	870	0.248	-	1.63	2.55	4.28	10	10	-	3.0	3.0	-
TD-100	850	0.1	-	-	-	-	10	10	-	1.1	1.1	-
	632.8									0.3	0.3	
TD-100A	850									1.1	1.1	
	670									0.6	0.6	
*****AIRCRAFT MOUNTED*****												
AIM-1/MLR	800-850	0.085	-	0.68	1.1	1.6	5	5	-	1.7	1.7	-
AIM-1/EXL	800-850	0.130	-	0.68	1.1	1.6	5	5	-	1.7	1.7	-

* Assume that built-in safety filter only protects against the wavelength of the laser in which it is installed and that it does not always protect against other laser wavelengths.
** WARNING! THIS HAZARD DATA COULD CHANGE SINCE DOD HAS NO CONTROL OVER MANUFACTURING OF THESE PRODUCTS. HAZARD CHARACTERISTICS IN THIS TABLE ARE VALID AS OF THE DATE OF DOD EVALUATION; PERIODICALLY CHECK WITH THE MANUFACTURER TO ENSURE THAT CHARACTERISTICS HAVE NOT CHANGED SINCE THE DATE OF THE LAST DOD EVALUATION.

4.2. Laser Hazard Zone: This is defined as the airspace within which a laser hazard exists to personnel intentionally or accidentally exposed to laser emission. This should be considered an "eye-hazard" space for the laser system. Personnel within this Laser Hazard Zone must wear Laser Eye Protection (LEP) to prevent laser eye damage. The Laser Hazard Zone extends from the laser output aperture to the NOHD for the viewing conditions considered (i.e., unaided viewing, 7x50 binocular viewing, etc.).

4.2.1 Laser Surface Danger Zone (LSDZ): This is defined as the ground area that intersects the Laser Hazard Zone. The LSDZ should be considered an "eye-hazard" zone for the laser system. Ground personnel within the LSDZ must wear LEP to prevent laser eye damage.

4.2.2 Factors Affecting Laser Accuracy. Several factors limit the laser system's ability to precisely place the laser on target. They together determine the extent of the Laser Hazard Zone associated with the laser's use. The following values will be required in order to establish accurate Laser Hazard Zones.

4.2.2.1 Beam Divergence: The laser beam expands as it propagates away from the exit aperture on the targeting pod.

4.2.2.2 Boresight Error: Due to engineering limitations in precisely aligning the laser with the IR image in the targeting pod FLIR, the laser may not always be shooting at the exact center of the display crosshairs.

4.2.2.3 Tracking Error: There is a limit in how accurately the IR system tracking software can maintain track of the target assuming a stable Point Track or Area Track with no operator inputs.

4.2.2.4 Combined Error: The combined boresight and tracking error introduce a ranked set sampling (RSS) error from the center of the crosshairs to the center of the laser beam.

4.2.3. Buffer Angles (Pointing Accuracy): The MIL-HDBK-828A procedure is to use 5 times the combined error for similar type systems and use this value for a "buffer-angle" in hazard zone calculations. This

combined buffer will determine a "Laser Hazard Zone (LHZ)" and "Laser Surface Danger Zone (LSDZ)". All laser system buffer angles are listed in Table 1.

4.3. Laser Footprints: The underlying concept of laser range safety is to prevent exposure of unprotected personnel to laser radiation in excess of the Maximum Permissible Exposure (MPE). This is accomplished by determining where the laser radiation is expected to be, restricting access of unprotected personnel, and removing reflective surfaces from the area. By determining where the laser radiation is expected to be, a laser footprint is created. A laser footprint is the projection of the laser beam and buffer zone on the ground or target area. The laser footprint may be part of the LSDZ if that footprint lies within the NOHD of the laser. Laser footprints can be generated through use of the Laser Range Management Software (LRMS), which was developed by AFRL/HEDO and is available at 4OSS/OSR. The following is a general discussion of what parameters to consider when evaluating man-portable or aircraft-mounted laser systems. A more detailed discussion on how to calculate the LSDZ can be found in Appendix D of MIL-HDBK-828A.

4.3.1 Man-Transportable Systems: When evaluating these systems, parameters required include system buffer angle, firing position elevation, target elevation, backstop elevation, firing position-to-target range, and target-to-backstop range. The buffer angles for fielded military systems are included in Table 1. For man-transportable systems not included in this table, contact either the local Base Radiation Safety Officer or our office. Typically, tripod-mounted systems have a 2 or 5 milliradian buffer angle, while hand-held lasers normally require 10 milliradians. One method to calculate the available vertical buffer angle (δ) between laser line-of-sight to target and laser line-of-sight to backstop is to use the following equation from MIL-HDBK-828A Appendix D:

$$\delta = \arctan((bl - h) / (dl + A)) + \arctan((h - al) / (dl)) \quad (1)$$

where:

h = firing position elevation
al = target elevation
bl = backstop elevation
dl = firing position-to-target range
A = target-to-backstop range

Note: For a graphical representation of the above equation, see Figure D-17 in MIL-HDBK-828A.

As long as the angle δ remains greater than the system buffer angle (α), the beam is safely contained vertically and the LSDZ only extends to the backstop. If the angle δ remains less than the system buffer angle (α), the beam is not safely contained and the LSDZ extends beyond the backstop. In this case, the LSDZ extends out to the NOHD of the system if no other structure exists for terminating the beam.

4.3.2 All fielded military man-transportable laser systems were evaluated for use at the following three firing positions (FPs): Left Tower, Center Tower, and Right Tower. Each tower has an elevation of 55 ft above ground level.

4.3.2.1 Some laser illuminators/pointers such as those from the GCP or IZLID series have a 10 mrad buffer zone, but have a minimal NOHD (< 300 m unaided viewing). Proper training mitigates the hazards associated with these types of devices. Therefore, LSDZs are not required and the devices are certified for all LTAs and from all FPs. Operations personnel should always be aware of system-specific NOHDs and their associated system buffer zones. These can be found in Table 1 of this report or MIL-HDBK-828A.

4.3.2.2 The man-transportable laser systems were certified for the LTA and FP combinations listed below in Tables 2-4. Combinations not certified are due the LSDZ not being contained within Government-controlled land. Note that some combinations may also not be effective due to inadequate line-of-sight between the FP and LTA. Also, keep in mind the target-to-laser safety zone as described in Section 5.2.1.3 of this report when designating from these positions. Attachment 2 represents the associated LSDZs for these specific FP and LTA combinations.

Man-Transportable Systems (cont.)

Table 2. Laser Target Areas that are Certified Safe for Man-Transportable Systems.

DARE COUNTY RANGE	LEFT TOWER				
	System Buffer Zone				
LASER TARGET AREA (LTA)	2 mrad	5 mrad	10 mrad (NOHD ≤ 300 m)	10 mrad (NOHD > 300 m)	15 mrad
01	YES	NO	YES	NO	NO
02	YES	YES	YES	NO	NO
03	YES	YES	YES	NO	NO
04	YES	YES	YES	NO	NO
05	NO	NO	YES	NO	NO
06	YES	YES	YES	YES	NO
07	YES	YES	YES	NO	NO
10	YES	YES	YES	NO	NO
11	YES	NO	YES	NO	NO
12	YES	NO	YES	NO	NO
13	YES	NO	YES	NO	NO
16	YES	NO	YES	NO	NO
17	YES	NO	YES	NO	NO
19	YES	NO	YES	NO	NO
20	NO	NO	YES	NO	NO
22	YES	NO	YES	NO	NO
24	YES	YES	YES	YES	YES
27	YES	NO	YES	NO	NO
36	YES	YES	YES	NO	NO
37	YES	NO	YES	NO	NO
38	YES	NO	YES	NO	NO
39	YES	NO	YES	NO	NO
40	YES	NO	YES	NO	NO
41	YES	NO	YES	NO	NO
42	YES	NO	YES	NO	NO
43	YES	NO	YES	NO	NO
44	YES	NO	YES	NO	NO
45	YES	NO	YES	NO	NO
46	YES	NO	YES	NO	NO
80	YES	NO	YES	NO	NO
81	YES	NO	YES	NO	NO
82	YES	NO	YES	NO	NO
99	YES	NO	YES	NO	NO

YES – Certified for laser use with the specified buffer zone
NO – Not certified for laser use with the specified buffer zone

Man-Transportable Systems (Cont.)

Table 3. Laser Target Areas that are Certified Safe for Man-Transportable Systems.

DARE COUNTY RANGE	CENTER TOWER				
	System Buffer Zone				
LASER TARGET AREA (LTA)	2 mrad	5 mrad	10 mrad (NOHD ≤ 300 m)	10 mrad (NOHD > 300 m)	15 mrad
01	YES	YES	YES	YES	NO
02	YES	YES	YES	NO	NO
03	YES	YES	YES	NO	NO
04	YES	YES	YES	NO	NO
05	YES	NO	YES	NO	NO
06	YES	YES	YES	YES	YES
07	YES	YES	YES	NO	NO
10	YES	YES	YES	NO	NO
11	YES	NO	YES	NO	NO
12	YES	NO	YES	NO	NO
13	YES	NO	YES	NO	NO
16	YES	NO	YES	NO	NO
17	YES	NO	YES	NO	NO
19	YES	NO	YES	NO	NO
20	YES	NO	YES	NO	NO
22	YES	NO	YES	NO	NO
24	YES	YES	YES	YES	NO
27	YES	NO	YES	NO	NO
36	YES	YES	YES	YES	NO
37	YES	YES	YES	NO	NO
38	YES	NO	YES	NO	NO
39	YES	YES	YES	YES	NO
40	YES	YES	YES	NO	NO
41	YES	YES	YES	NO	NO
42	YES	YES	YES	NO	NO
43	YES	YES	YES	NO	NO
44	YES	YES	YES	NO	NO
45	YES	YES	YES	NO	NO
46	YES	YES	YES	NO	NO
80	YES	YES	YES	NO	NO
81	YES	YES	YES	NO	NO
82	YES	YES	YES	NO	NO
99	YES	NO	YES	NO	NO

YES – Certified for laser use with the specified buffer zone
NO – Not certified for laser use with the specified buffer zone

Man-Transportable Systems (Cont.)

Table 4. Laser Target Areas that are Certified Safe for Man-Transportable Systems.

DARE COUNTY RANGE	RIGHT TOWER				
	System Buffer Zone				
LASER TARGET AREA (LTA)	**2 mrad**	**5 mrad**	**10 mrad (NOHD ≤ 300 m)**	**10 mrad (NOHD > 300 m)**	**15 mrad**
01	YES	YES	YES	YES	NO
02	YES	YES	YES	NO	NO
03	YES	YES	YES	NO	NO
04	YES	YES	YES	NO	NO
05	YES	YES	YES	NO	NO
06	YES	YES	YES	NO	NO
07	YES	NO	YES	NO	NO
10	YES	NO	YES	NO	NO
11	YES	NO	YES	NO	NO
12	YES	NO	YES	NO	NO
13	YES	NO	YES	NO	NO
16	YES	NO	YES	NO	NO
17	YES	NO	YES	NO	NO
19	YES	NO	YES	NO	NO
20	YES	NO	YES	NO	NO
22	YES	YES	YES	NO	NO
24	YES	NO	YES	NO	NO
27	YES	NO	YES	NO	NO
36	YES	YES	YES	NO	NO
37	YES	YES	YES	NO	NO
38	YES	YES	YES	NO	NO
39	YES	YES	YES	NO	NO
40	YES	YES	YES	NO	NO
41	YES	YES	YES	NO	NO
42	YES	YES	YES	NO	NO
43	YES	YES	YES	NO	NO
44	YES	YES	YES	NO	NO
45	YES	YES	YES	NO	NO
46	YES	YES	YES	NO	NO
80	YES	NO	YES	NO	NO
81	YES	NO	YES	NO	NO
82	YES	YES	YES	NO	NO
99	YES	NO	YES	NO	NO

YES – Certified for laser use with the specified buffer zone
NO – Not certified for laser use with the specified buffer zone

4.3.3 Aircraft-Mounted Systems: Aircraft-mounted systems are included on both fixed- and rotary-wing aircraft. However, since rotary-wing aircraft designate targets from mainly a stationary position, their footprints can be calculated using the method described in section 4.3.1. When evaluating fixed-wing systems, it is important to determine desired flight profiles. Flight information necessary to perform an evaluation includes the aircraft's altitude, slant range-to-target, and directions of the aircraft relative to the target during laser operations. A determination of the maximum allowable footprint must be made. This distance may be defined by simple observation of distance from target to range boundary or manned facility. The projected laser footprint from the aircraft can be determined by using modified equations from MIL-HDBK-828A Appendix D:

$$A = (R*\sin(\alpha)) / [\sin(\arcsin(h/R) - \alpha)] \quad (2)$$

$$B = (R*\sin(\alpha)) / [\sin(\arcsin(h/R) + \alpha)] \quad (3)$$

where:

A = Forward footprint (distance from the target to the forward geometric boundary)
B = Aft footprint (distance from the target to the aft geometric boundary)
R = Slant range from the laser to the target
α = Buffer angle plus half-angle divergence as defined in MIL-HDBK-828A
h = Altitude of the laser above ground level (AGL)
Note: For a graphical representation of the above equation, see Figure D-19 in MIL-HDBK-828A.

For most cases, the largest footprint is made with the longest slant range and lowest lasing altitude combination. By varying the AGL and slant range, the correct combination for a projected footprint that is smaller, or equal, to the maximum allowable footprint can be determined. Once this combination is determined, the corresponding forward (A) and aft (B) values can be used to create the "Limitation on Flight Profile" plots, as shown in Figures 1 and 2, by using the following equations and plotting altitude (h) versus slant range (R):

Forward Footprint $h = R * \sin(\arcsin(((R / A) * \sin(\alpha)) + \alpha))$ (4)

Aft Footprint $h = R * \sin(\arcsin(((R / B) * \sin(\alpha)) - \alpha))$ (5)

These combinations are also shown with a linear scale in Figure 1-a. The dimensions of the largest, certified LSDZ (flat terrain) about a single target result in a laser footprint 537 ft. forward of the target, 518 ft. aft of the target, and a width of 122 ft. at the target. These dimensions are also only applicable for the Combat Modes of the aircraft-mounted systems listed in Table 1. See section 4.3.4 for discussion concerning the laser system's training mode.

4.3.3.1 LANTIRN/LITENING II/IRADS: As listed in MIL-HDBK-828A, the USAF has assigned a 2 mrad buffer zone to the combat modes of the LANTIRN, LITENING II, and IRADS laser systems. To determine the largest LSDZ about any target, we evaluated the following laser weapon delivery profiles for LANTIRN/LITENING II/IRADS-equipped aircraft:

(1) System Level Delivery
(2) Laser Loft
(3) High Altitude
(4) Dive
(5) "Buddy Lasing"

The largest LSDZ occurs at the lowest altitude and longest slant range combination. For Dare County Range, a "worst-case" profile of 3,500 feet AGL and 5.0 NM during the "System Level" laser weapon delivery will produce a laser footprint (flat terrain) 537 ft forward of the LTA, 518 ft aft, and a width of 122 ft. This profile and associated footprint dimensions are applicable to the combat modes of the specified systems. The actual Dare County Range LSDZs, shown for these LTAs and available laser headings, are given in Attachment 3. Note that these LSDZs have a terrain-obscured footprint that may be larger or smaller than the dimensions provided for flat terrain. The exact dimensions can be checked with LRMS.

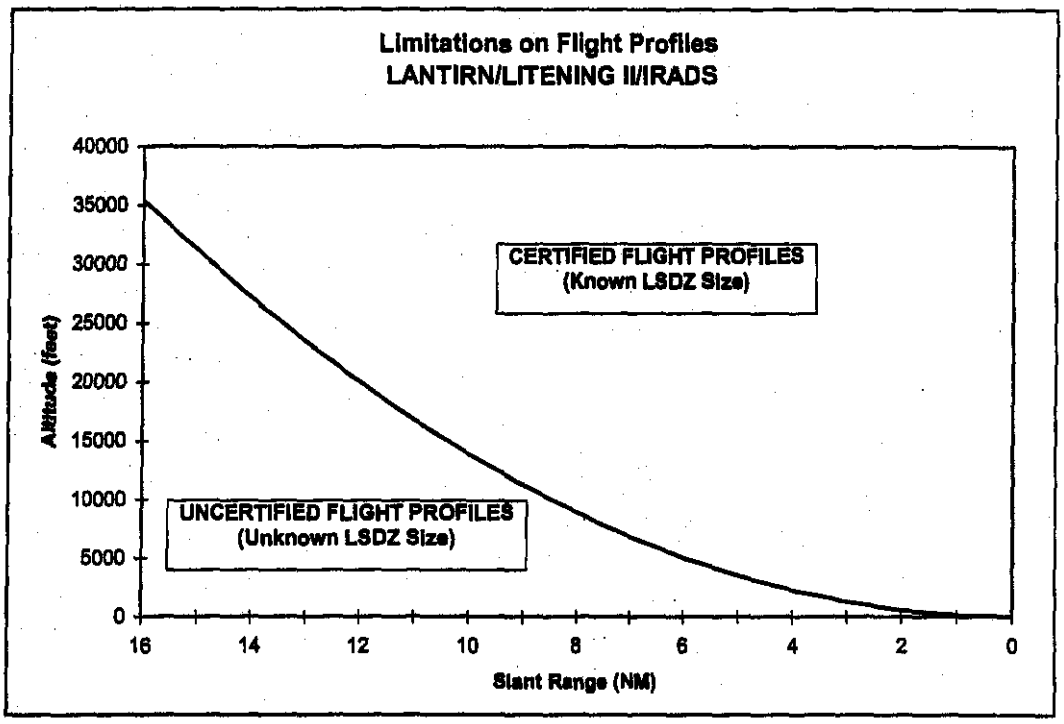


Figure 1. Limitations on Altitude and Slant Range Based upon a Forward Footprint of 537 ft. (LANTIRN/LITENING II/IRADS)
Note: Unrestricted Laser Headings

SLANT RANGE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)	SLANT RANGE TO TARGET (NM)	MINIMUM SAFE LASING ALTITUDE (ft) (AGL)
16	36,296	8	9,026
15	31,890	7	6,900
14	27,768	6	5,059
13	23,932	5	3,503
12	20,380	4	2,249
11	17,114	3	1,274
10	14,133	2	575
9	11,437	1	150

Figure 1-a. Limitations on Altitude and Slant Range-linear scale.

4.3.3.2 OTHER Systems: As listed in MIL-HDBK-828A, a 5 mrad buffer angle is given for all other aircraft-mounted systems (AN/AAS-38 & 38A on F/A-18A-f, etc.) currently in use. To determine the largest LSDZ about any target, we evaluated the following laser weapon delivery profiles for aircraft equipped with other laser systems:

(1) System Level Delivery
(2) Laser Loft
(3) High Altitude
(4) Dive
(5) "Buddy Lasing"

To produce a laser footprint equal to that of the previous example (4.3.3.1), the flight profile (altitude and slant range of the aircraft) must be adjusted accordingly. The impact of a larger buffer angle is clear to see in Figure 2. This profile and associated footprint dimensions are applicable to the OTHER systems specified above. The actual Dare County Range LSDZs, shown for these LTAs and available laser headings, are also provided in Attachment 3. Note that these LSDZs have a terrain-obscured footprint that may be larger or smaller than the dimensions provided for flat terrain. The exact dimensions can be checked with LRMS.

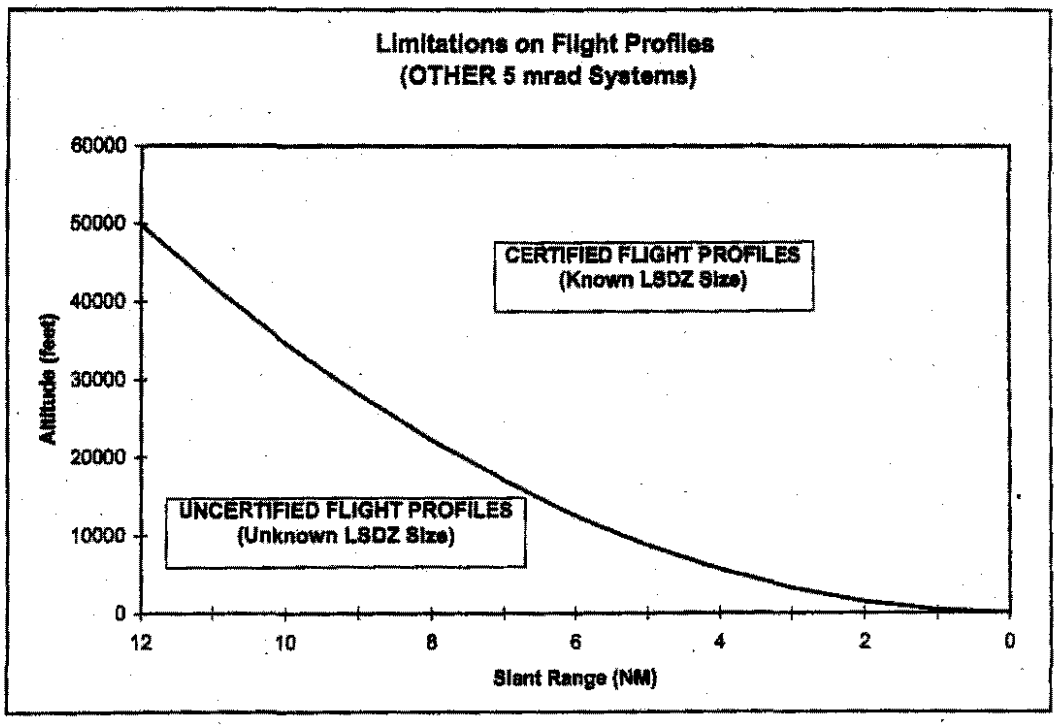


Figure 2. Limitations on Altitude and Slant Range Based upon a Forward Footprint of 537 ft. (OTHER 5 mrad systems)
Note: Unrestricted Laser Headings

SLANT RANGE TO TARGET (NM)	**MINIMUM** SAFE LASING ALTITUDE (ft) (AGL)	SLANT RANGE TO TARGET (NM)	**MINIMUM** SAFE LASING ALTITUDE (ft) (AGL)
12	50,950	6	12,647
11	42,784	5	8,757
10	35,331	4	5,581
9	28,591	3	3,116
8	22,564	2	1,365
7	17,249	1	326

Figure 2-a. Limitations on Altitude and Slant Range-linear scale.

4.3.4 Laser System Training Mode: Both the AN/AAQ-14 LANTIRN and AN/AAQ-28 LITENING II targeting pods have the capability to operate in a Training Mode. This eye-safe training capability allows pilots to simulate weapons deliveries. While both systems are able to accurately calculate target range, providing eye-safe ranging over all areas, the AN/AAQ-14 LANTIRN accomplishes this by lasing a tenth of the energy per pulse at a wavelength (1540 nm) that requires more energy than the combat mode to damage the eye while the AN/AAQ-28 LITENING II is able to accomplish this without firing the laser.

4.3.4.1 While the AN/AAQ-14 and AN/AAQ-28 systems are in Training Mode, all Dare County Range LTAs are certified safe-to-use without restriction.

4.3.5 Table 5 lists the allowable LTAs, aircraft-mounted system, and available laser headings certified for use on Dare County Range. These available laser headings are applicable to all tactical laser delivery profiles listed previously, but may be further restricted by the local Range Authority. Attachment 3 represents the associated LSDZs for Dare County Range. Note that LSDZs for LTAs 05 & 20 extend beyond the impact area but are still contained within Government-controlled land. LSDZs are not required for the Training Mode of the laser systems listed in Table 1 since they are eye-safe.

Table 5. Certified Laser Target Areas (LTAs) and Available Laser Headings for Specified Laser Systems

DARE COUNTY RANGE Laser Target Area (LTA)	LANTIRN and LITENING II (Training Mode) Certified Use and Available Laser Headings	LANTIRN and LITENING II (Combat Mode - 2 mrad), and IRADS Certified Use and Available Laser Headings	OTHER (Combat Mode - 5 mrad) Certified Use and Available Laser Headings
All LTAs	**YES**; 000° to 360°	**YES**; 000° to 360°	**YES**; 000° to 360°

YES - Certified for use with the specified laser system
NO - Not certified for use with the specified laser system

5. Conclusions and Recommendations:

5.1. The Dare County Range has a laser safety program that is in compliance with AFOSH 48-139 and AFI 13-212. Range laser safety instructions are currently provided in AFI 13-212V1/SJAFB Sup 1: March 2002. Future Range Regulations shall incorporate guidance provided in this report. The laser systems listed in Table 1 are certified for use within the Dare County Range provided that the guidelines provided in this consultative letter are observed. Specific guidelines include the following:

5.1.1 The laser systems are used only against the LTA's listed in this report.

5.1.2 All aircraft-mounted laser operations commence and end within the confines of restricted airspace for the range.

5.1.3 All laser operators meet the following minimum criteria:

5.1.3.1 Have received appropriate laser range briefing by the training Laser Safety Officer (LSO) or other approved qualified personnel.

5.1.3.2 Have received training in the proper and safe use of the laser systems employed.

5.1.3.3 Have positive communication with the Range RCO/LSO during laser operations.

5.1.4 Fire aircraft-mounted lasers only after positive identification of the target and after ensuring that the LTA and the LSDZ are clear of unauthorized personnel.

5.1.5 The Range RCO/LSO shall take the LSDZ into consideration when planning any laser operation activity.

5.1.6 Warn all personnel on the range of imminent laser operations.

5.1.7 Prior to air-to-ground laser operation, pilots should make a cold (non-lasing) pass, if possible, to ensure that the LTA and corresponding LSDZ are clear of unauthorized personnel.

5.1.8 Ensure that all personnel in the vicinity of Dare County Range remain outside the LTA and LSDZ during laser operations or wear appropriate laser eye protection (LEP) corresponding to the wavelength and optical density listed in Table 1.

5.1.9 Dare County Range personnel use old, military vehicles as laser targets. For air-to-ground lasing operations, the entire LSDZ shall be cleared of specular reflectors. Any painted object should be periodically examined for flaking or wear of the paint.

5.1.10 Laser warning signs shall be posted, at a minimum, to the range main access areas during laser operations. Periodic checks and replacement of all laser-warning signs should be part of the LSO's preventive maintenance schedule.

5.1.11 Laser operations must be immediately stopped if unauthorized personnel are observed in the LSDZ, equipment malfunction is observed, target is lost in field of view, or anytime laser safety cannot be assured. Essential personnel in the LSDZ shall wear appropriate LEP corresponding to the wavelength and optical density listed in Table 1.

5.1.12 No Class 3b or 4 lasers shall be fired above the horizon or backstop (i.e., hills, trees, or large targets) without prior coordination with NORAD and the FAA. NORAD POC: Orbital Safety Officer, FAX: (719) 474-3604, Voice: (719) 474-4496, DSN: 268-3604 or 268-4496. FAA POC: Contact the FAA Regional Office for further information.

5.1.13 Keep a record showing the date for each laser mission.

5.1.14 Since water can become a flat specular reflector when it is calm (i.e., mirror-like surface), the reflection hazard to personnel in other aircraft increases and additional precautions are required. The decision to use a target for lasing when calm, standing water is present should be made by the RCO/LSO. Under this circumstance, only one aircraft should be allowed on Dare County Range at a time.

5.1.15 For suspected laser eye injuries, follow the guidance IAW AFOSH 48-139 and complete the Laser Radiation Injury Checklist provided in Attachment 4.

5.2. The following is a general discussion of some specific laser hazards associated with mission tactics that a Range LSO should be aware of and address in laser safety instructions, if necessary.

5.2.1 There are several aircraft laser scenarios that have tactics that result in aircraft headings that are different from the laser heading. The LSDZs are based on the heading of the laser and not on the heading of the aircraft. When a laser mission is planned, it is important to use the appropriate laser safety profile for determining the laser hazard zone.

5.2.1.1 In some exercises, the laser is fired from at least two discrete points. The first time the laser is used, it is used for ranging type operations. At this point it is generally aimed at the target on the same heading as the aircraft and is turned off prior to releasing the ordnance. However, after the aircraft has released its ordnance and turned away (approximately 90 degrees), the laser may be re-energized in order to guide the bomb to the target. This creates a problem from a laser safety perspective in that the LSDZ is dramatically different when the laser is fired the second time because it is firing from a different heading. In order to perform this type of exercise, the LSDZ for the target and target area has to be calculated for a full 360-degree range of laser headings. If the laser safety profile is only for a specific heading, then it is not possible to perform these types of exercises at that target.

5.2.1.2 Another type of aircraft tactic, called Continuously Computing Impact Position (CCIP), is where the pilot turns the laser on well short of the target and lases the ground prior to the target. This type of operation poses a problem for point targets or targets at the edge of the target area as any LSDZs are invalid if the laser operator is aiming the laser outside the LTA. The LSDZs calculated in this report generally encompass target areas. However, in order to maintain the safety parameters established by these LSDZs, it is important that the laser only be turned on while it is aiming at the LTA. If the target being lased is a point target or has only a small LTA, CCIP-type missions should not be permitted.

5.2.1.3 When man-transportable, rotary-wing, or wingman-aircraft (buddy lasing) based laser systems are designating for another aircraft carrying the laser guided weapon, there are important safety patterns to consider. The reason for this is that with certain types of aircraft laser targeting systems, there is a chance that the targeting system will false-lock on the laser position because it sees the laser source before it sees the target. Designator profiles behind the weapon launch platforms are the safest, but if that is not possible a profile should be selected that keeps the designator out of the laser guided weapon's field of view (FOV). The proper exclusionary zone varies from system to system. The Joint Close Air Support Manual 3-09.3 requires a 20 degree safety zone extending from the target back to the laser designator firing position. The aircraft with the laser-guided weapon should avoid approaching along this 20 degree range of headings. However, if that is unavoidable, the pilot should offset the heading ten (10) degrees right or left to preserve safety standards.

6. Summary:

Dare County Bombing Range has a laser safety program that is in compliance with AFI 13-212 and AFOSH 48-139. The AN/AAQ-14 LANTIRN and AN/AAQ-28 LITENING II targeting pods (Training Mode only) listed in Table 1 are certified for use on all targets within the Dare County Range without restriction. The aircraft-mounted (Combat Mode) and man-transportable laser systems listed in Table 1 are certified for use on specific targets within the Dare County Range provided that the guidelines provided in this consultative letter are observed. This report documents AFRL/HEDO certification for laser operations (in accordance with contained guidance) on Dare County Range. The local Range Operating Authority (ROA) must also authorize before laser operations may commence. This certification is valid for up to three years and will expire in September 2005.

NOTE: The flight profiles discussed in this report are not to be construed as mandated aircraft flight paths but as boundary limits at a given location that distinguish between safe and unsafe laser use. This evaluation addresses only those systems approved for general training scenarios. A separate evaluation should be done on a case-by-case basis by the training facility Laser Safety Officer (LSO), qualified Bioenvironmental Engineer/Health Physicist, or AFRL/HEDO on laser systems used in nontraditional modes, R&D applications, and prototype systems. Force-on-force scenarios are not evaluated in this report and should only be allowed with the express consent of the training facility LSO using safety parameters established by the LSO and the qualified personnel mentioned above on a case-by-case basis.

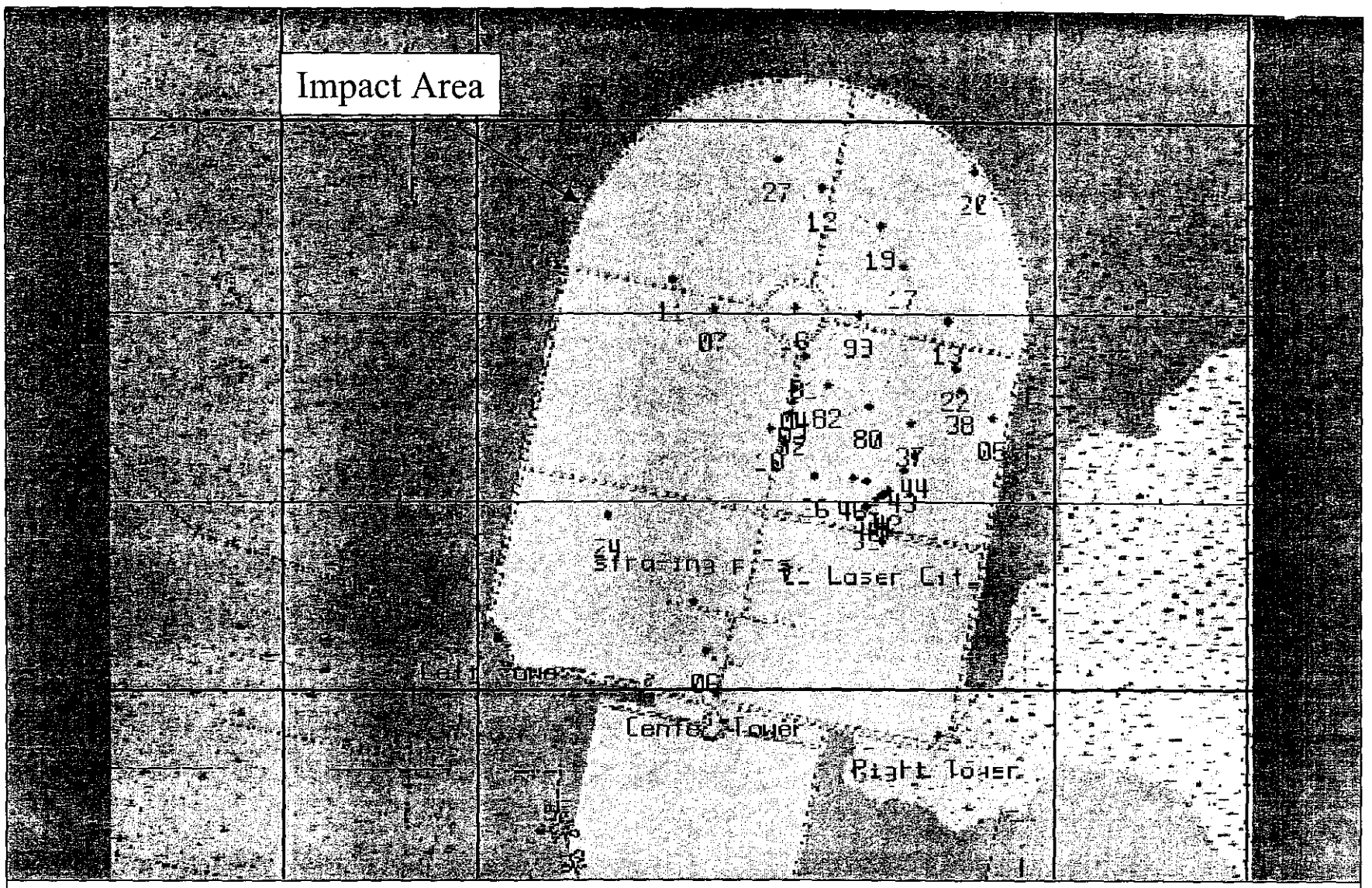
7. Please contact the Optical Radiation Safety Team at DSN 240-3718 or 800-473-3549 if you have any questions concerning this report.

//s//
WILLIAM P. ROACH, Lt Col, USAF, BSC
Chief, Optical Radiation Branch

Attachments:
1. Dare County Range Manned Positions and Laser Target Areas
2. Dare County Range Man-Transportable Systems Laser Surface Danger Zones
3. Dare County Range Aircraft-Mounted Systems Laser Surface Danger Zones
4. Laser Radiation Injury Checklist

Cc:
HQ ACC/DORR
4th AMDS/SGPB

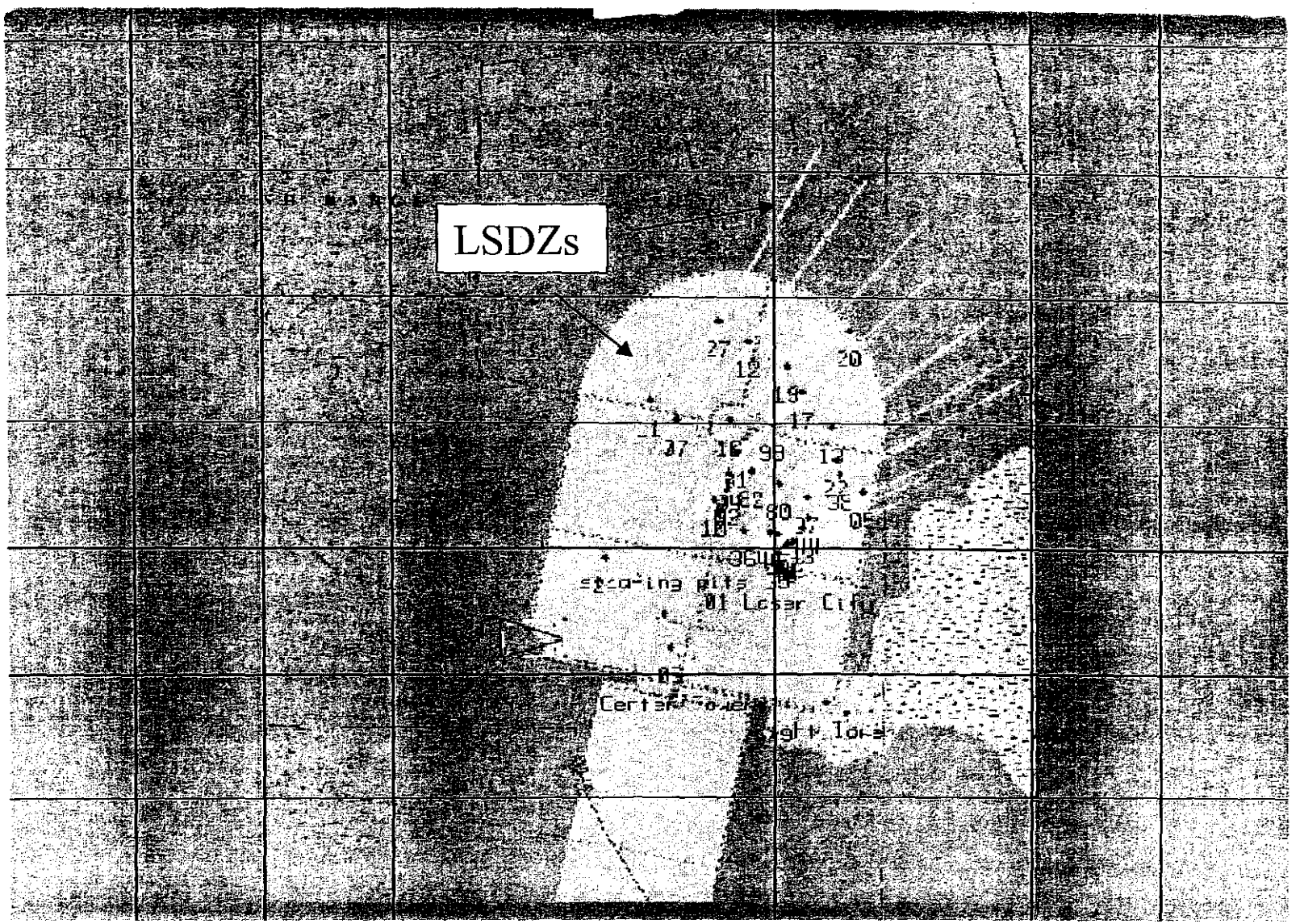
Attachment 1: Dare County Range Manned Positions and Laser Target Areas



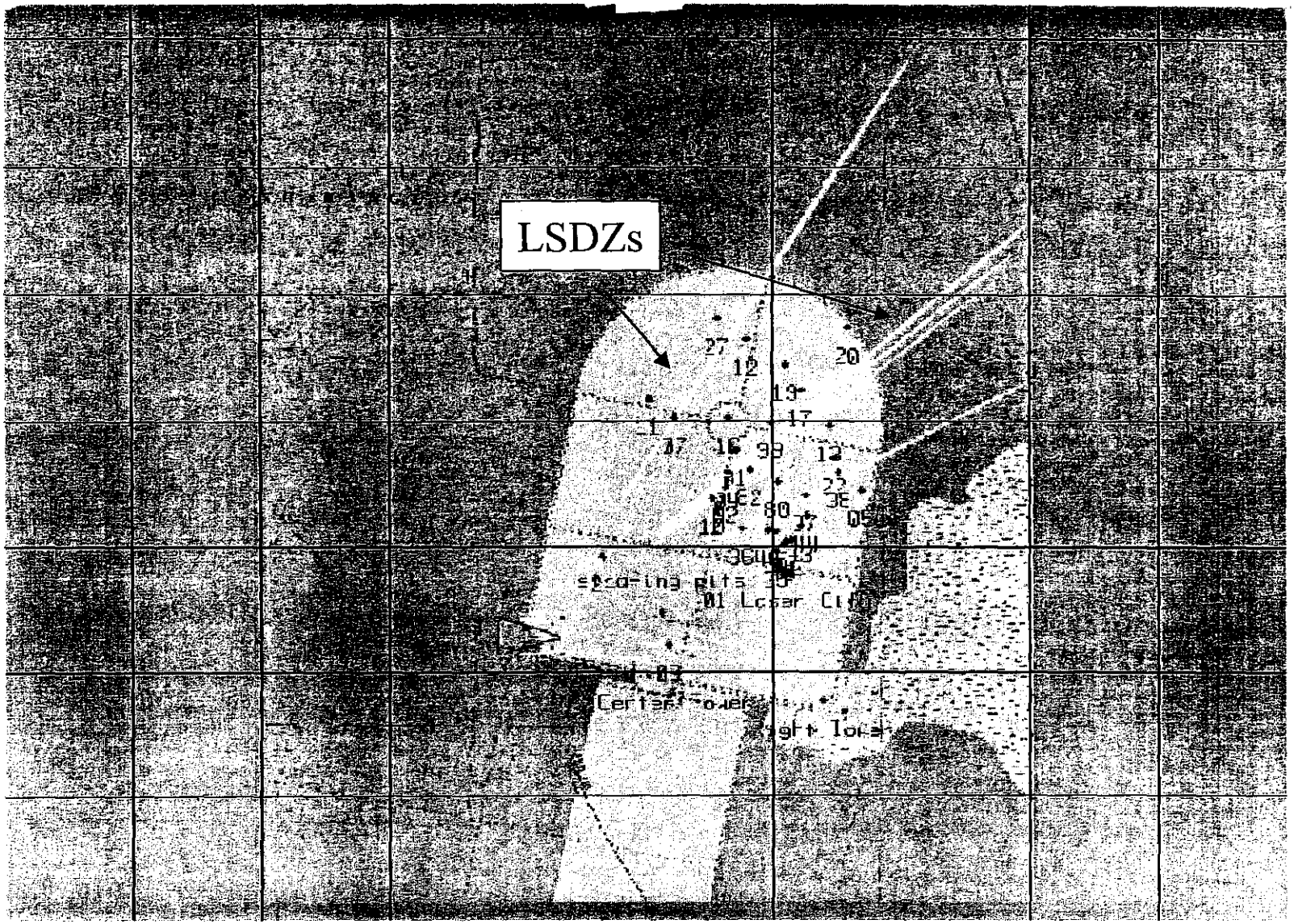
Dare County Bombing Range: Laser Target Areas and Manned Positions

Scale: 1 square = 1000 m	Figure A-1	Grid North
	Laser Target Areas: All	

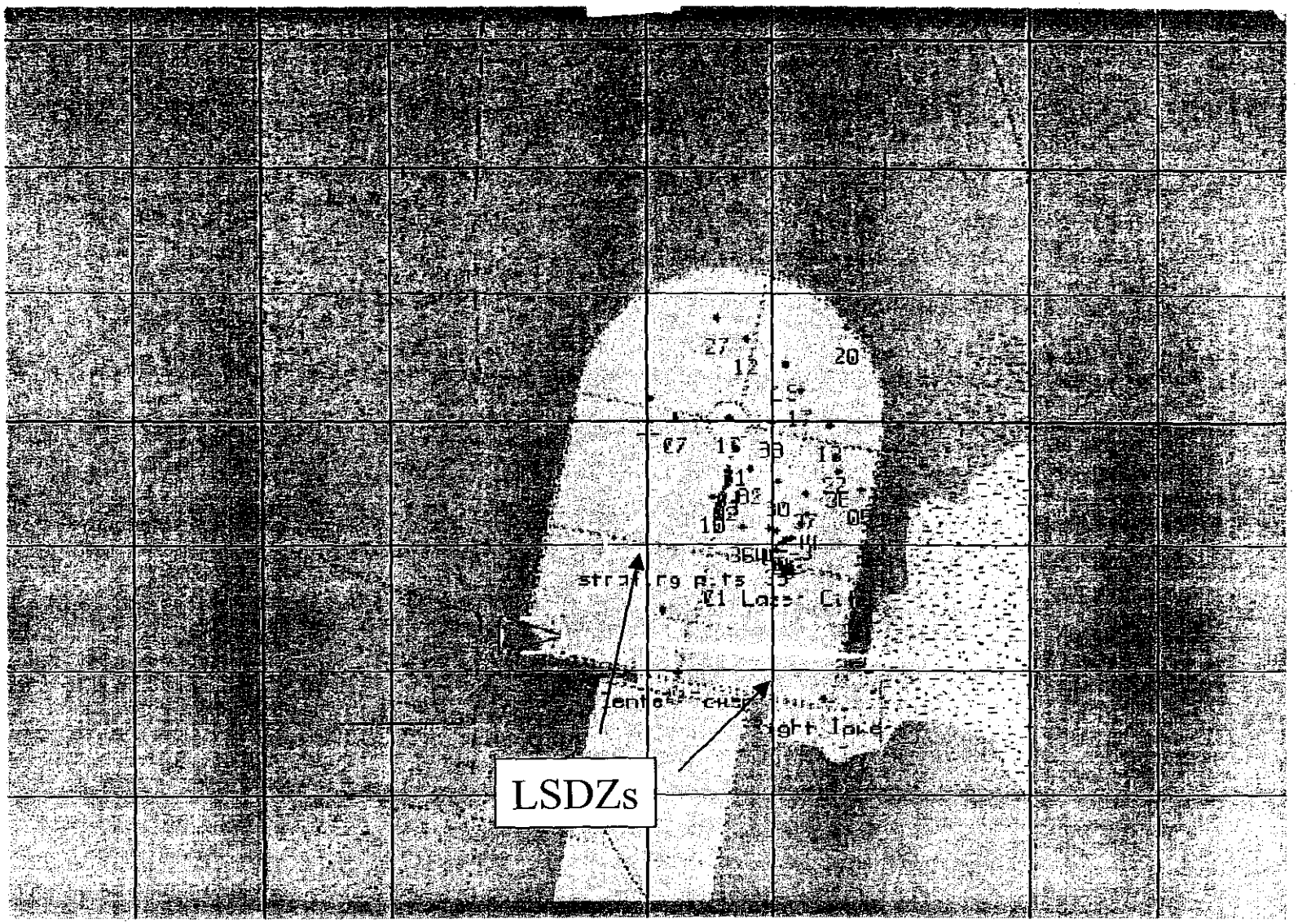
Attachment 2: Dare County Range Man-Transportable Systems Laser Surface Danger Zones



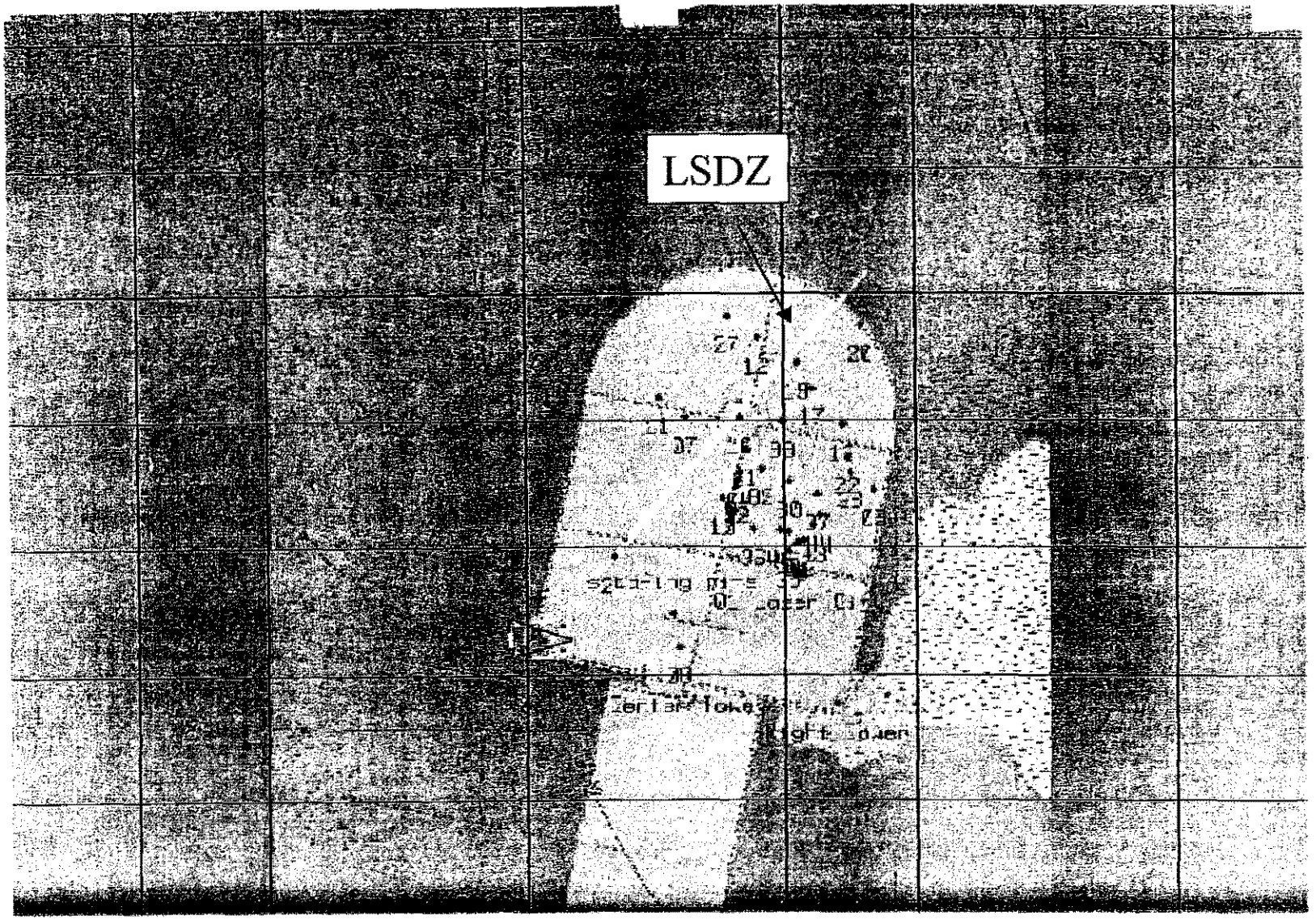
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-1	Firing Position: Left Tower
Grid North	Laser Target Areas: All (except 05 and 20)	Buffer Zone: 2 mrad



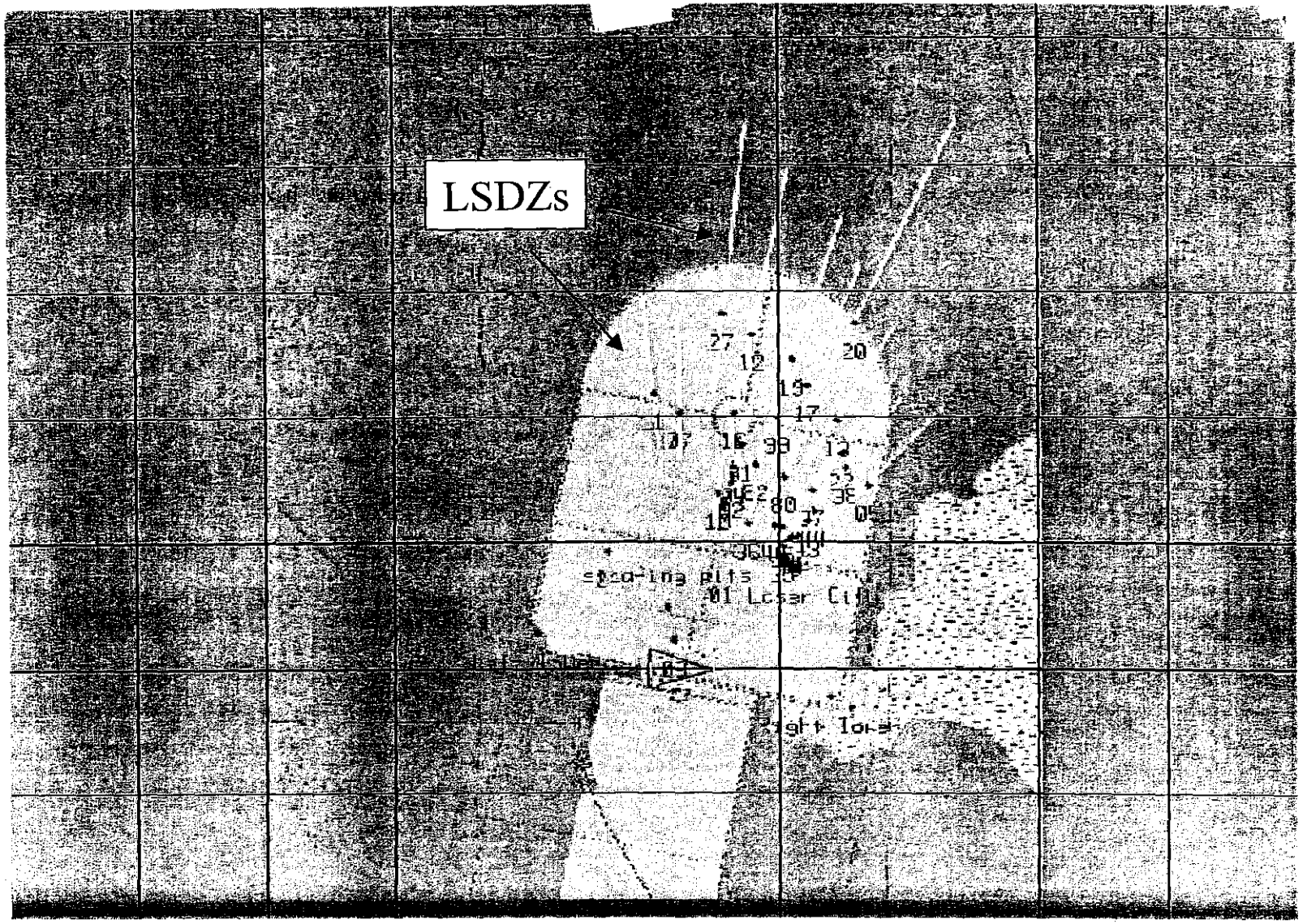
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-2	Firing Position: Left Tower
Grid North	Laser Target Areas: (02, 03, 04, 06, 07, 10, 24, 36,)	Buffer Zone: 5 mrad



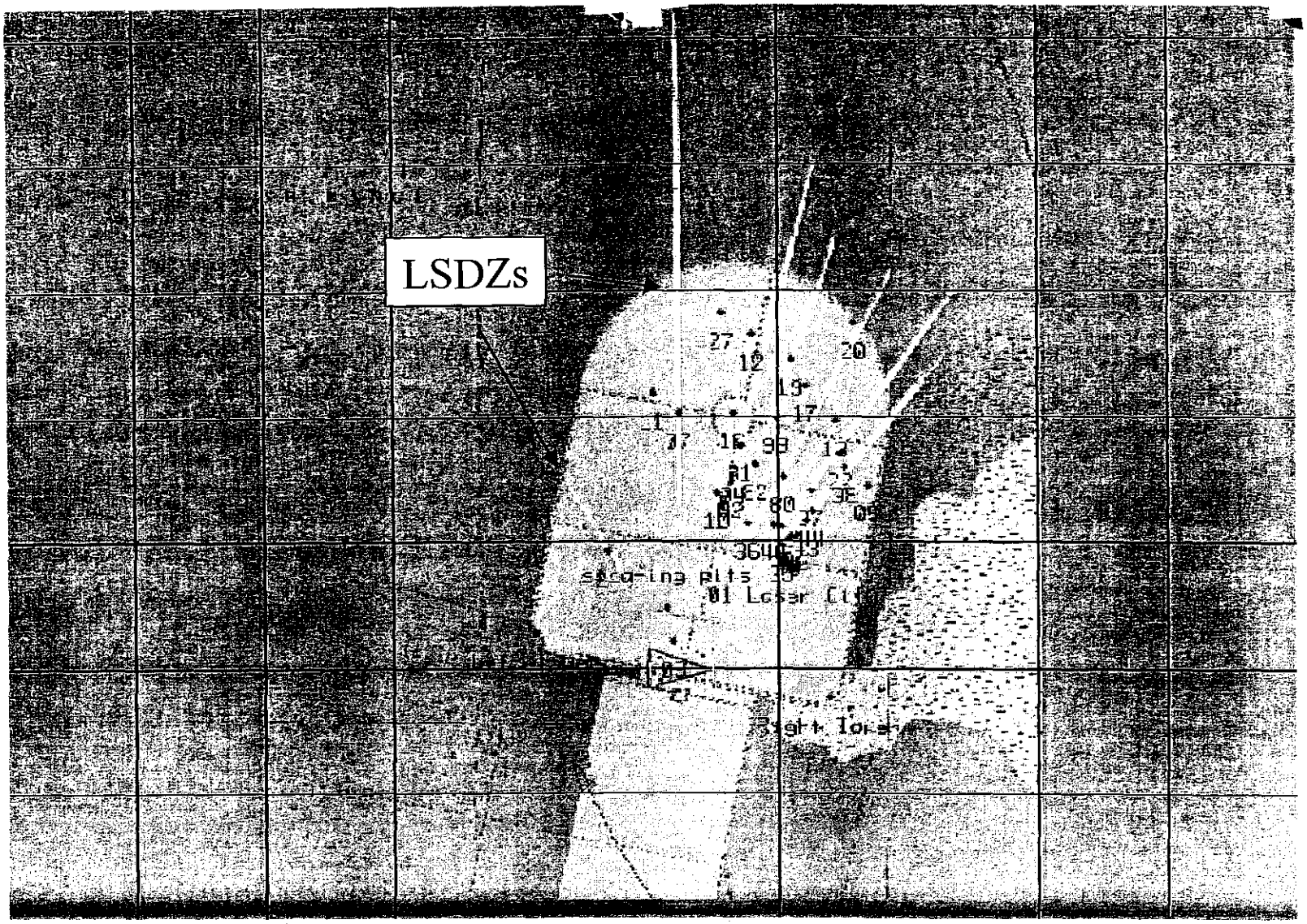
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-3	Firing Position: Left Tower
Grid North	Laser Target Areas: (06, 24)	Buffer Zone: 10 mrad



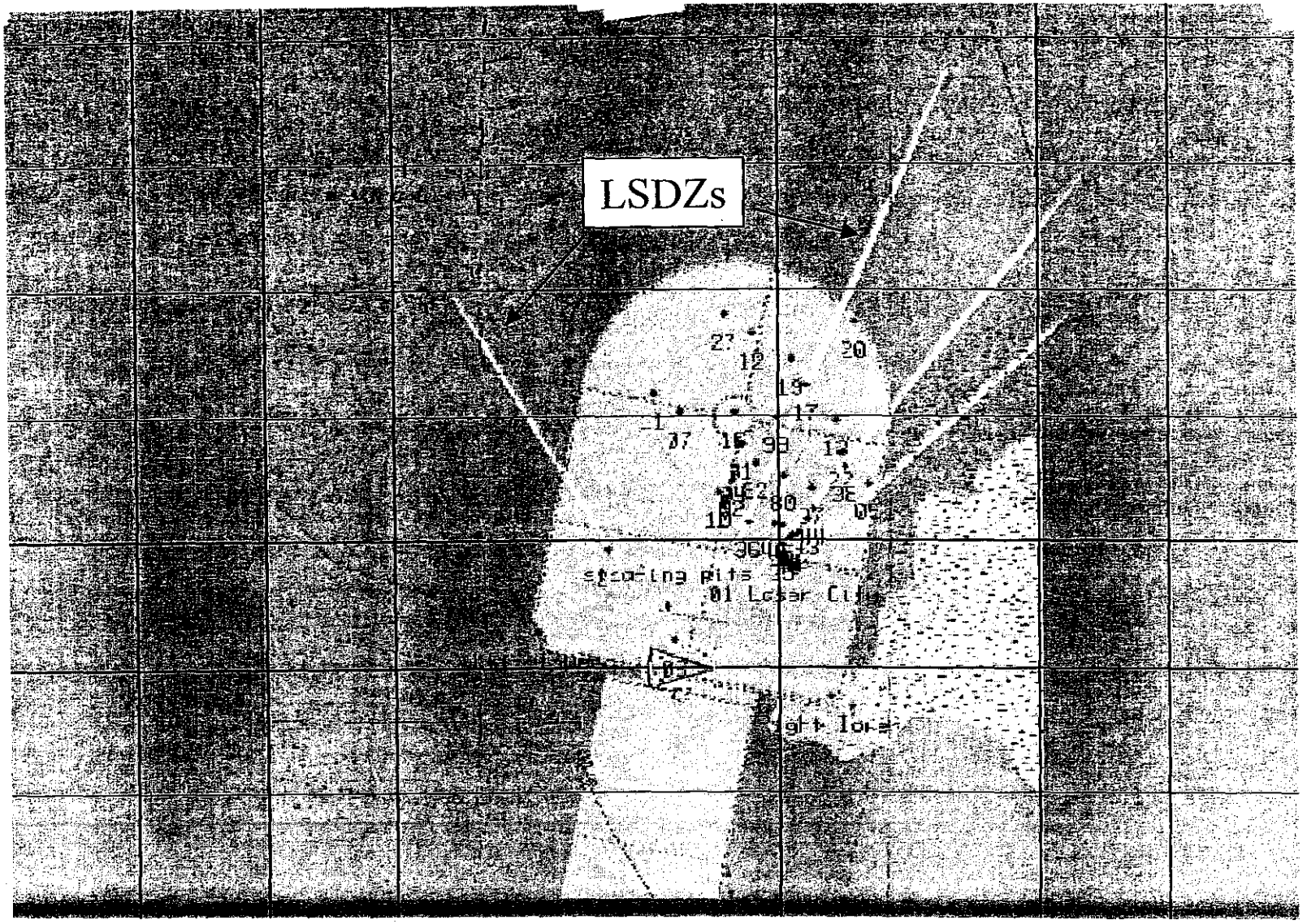
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-4	Firing Position: Left Tower
Grid North	Laser Target Areas: (24)	Buffer Zone: 15 mrad



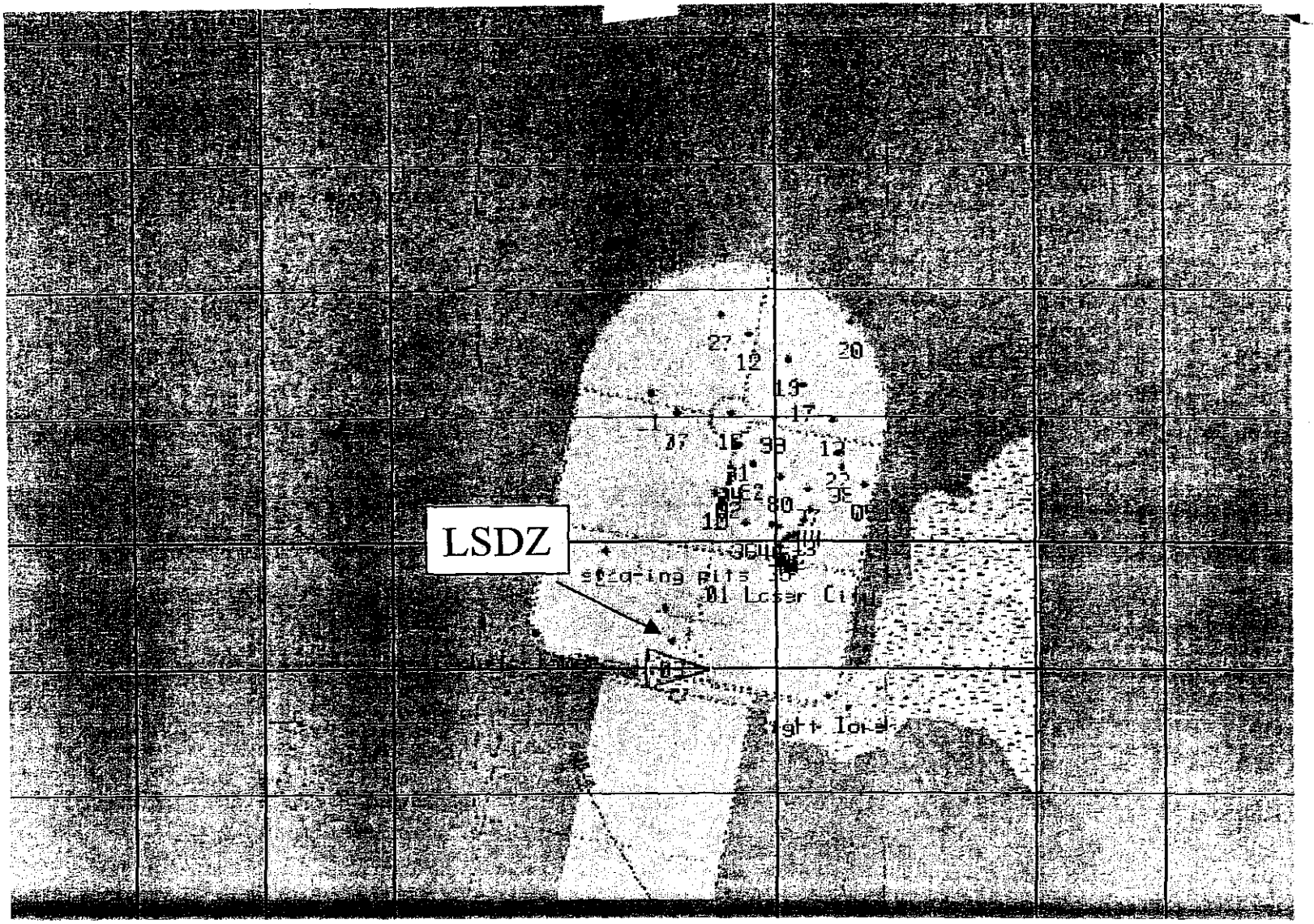
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-5	Firing Position: Center Tower
Grid North	Laser Target Areas: All	Buffer Zone: 2 mrad



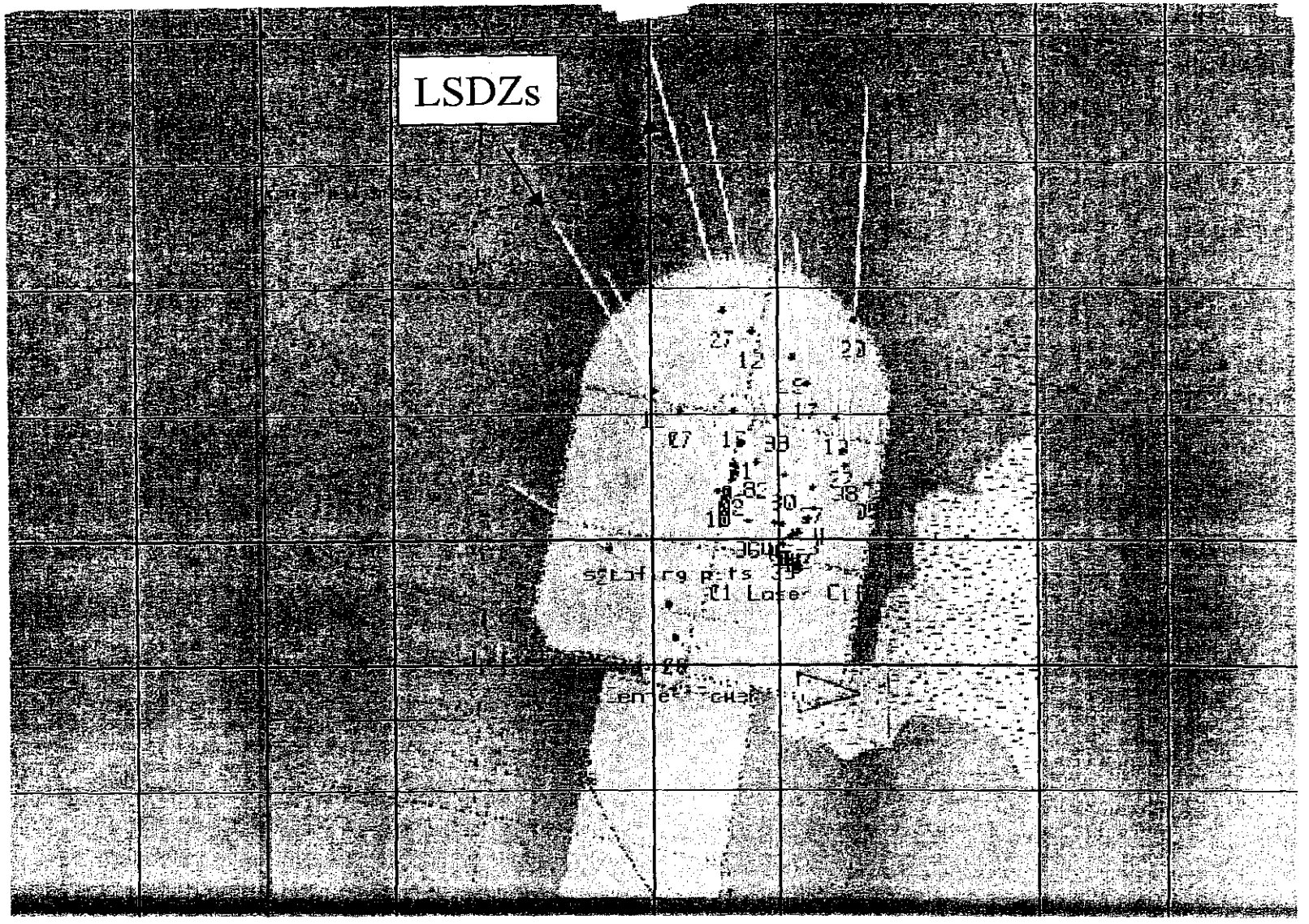
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-6	Firing Position: Center Tower
Grid North	Laser Target Areas: (All except 05, 11, 12, 13, 16, 17, 19, 20, 22, 27, 38, 99)	Buffer Zone: 5 mrad



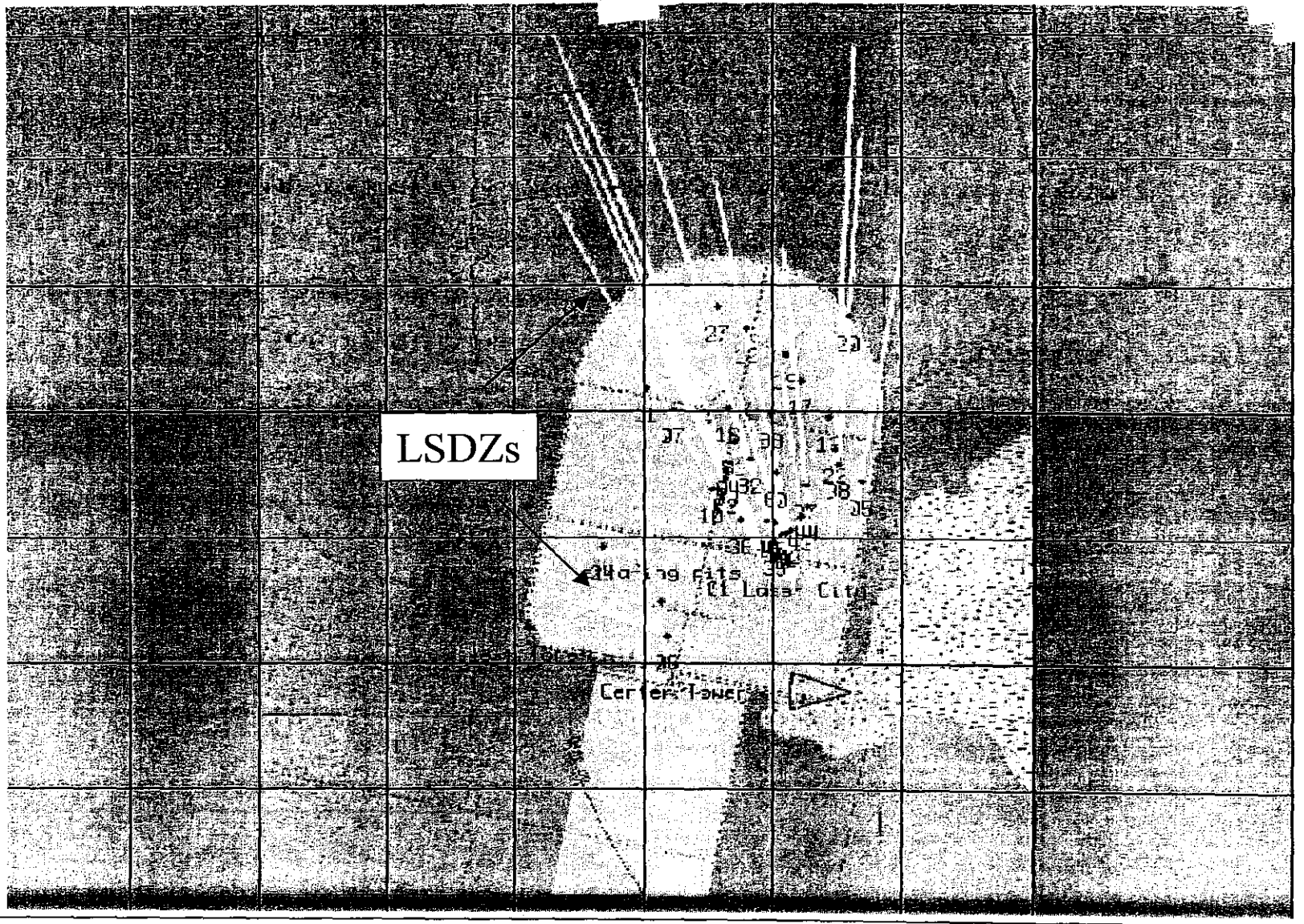
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-7	Firing Position: Center Tower
Grid North	Laser Target Areas: (01, 06, 24, 36, 39)	Buffer Zone: 10 mrad



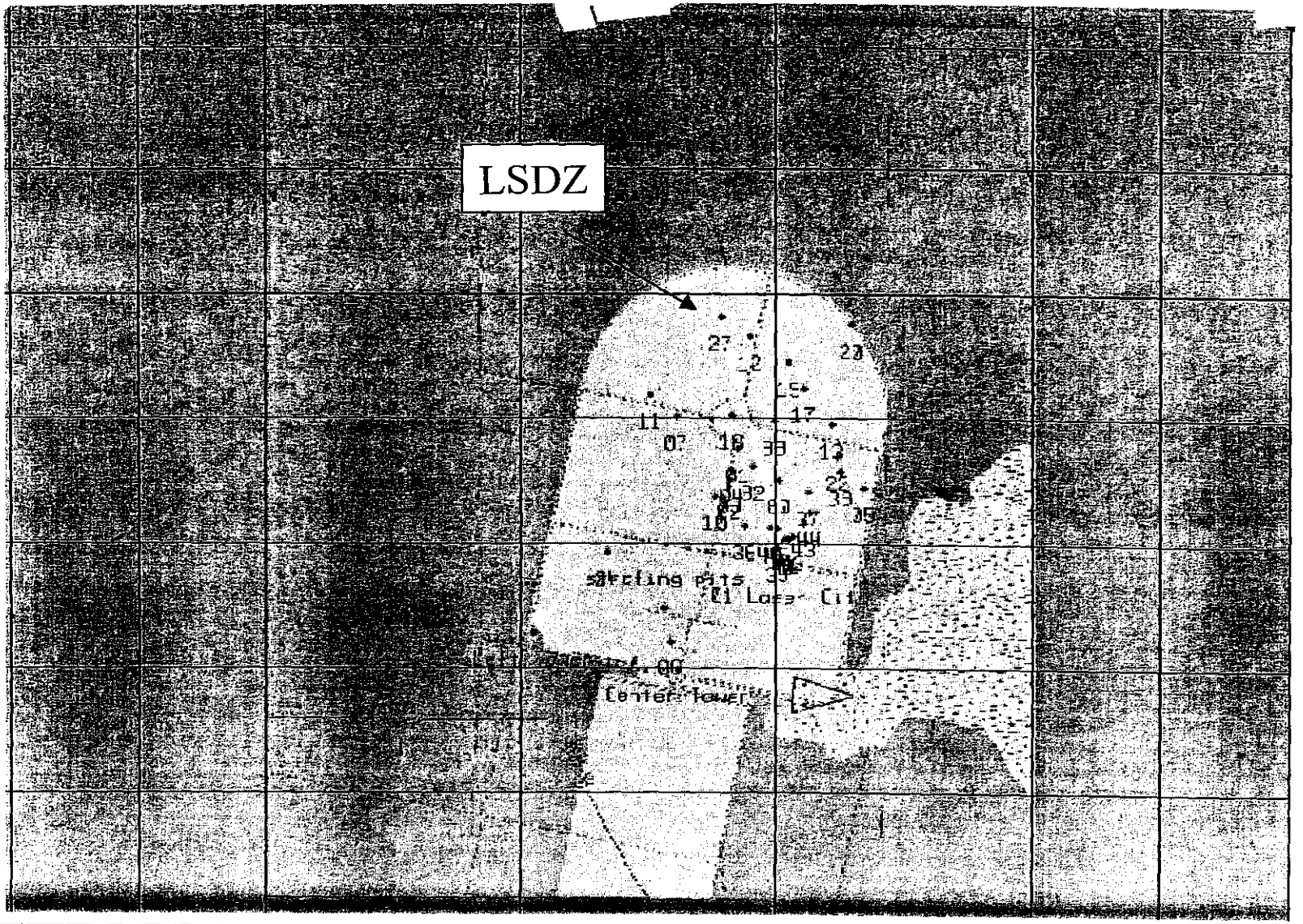
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-8	Firing Position: Center Tower
Grid North	Laser Target Areas: (06)	Buffer Zone: 15 mrad



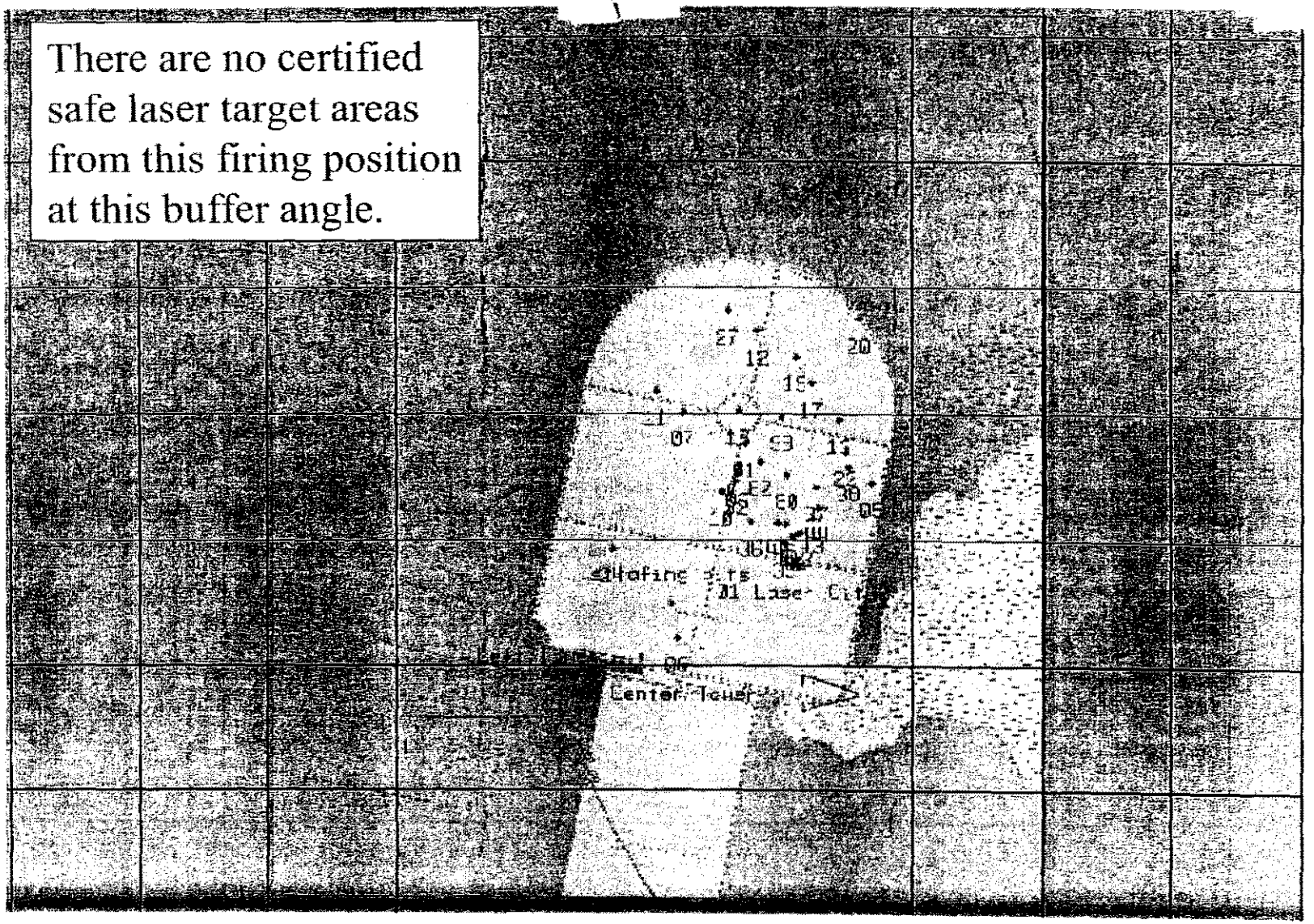
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-9	Firing Position: Right Tower
Grid North	Laser Target Areas: All	Buffer Zone: 2 mrad



Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-10	Firing Position: Right Tower
Grid North	Laser Target Areas: (All except 07, 10, 11, 12, 13, 16, 17, 19, 20, 24, 27, 80, 81, 99)	Buffer Zone: 5 mrad

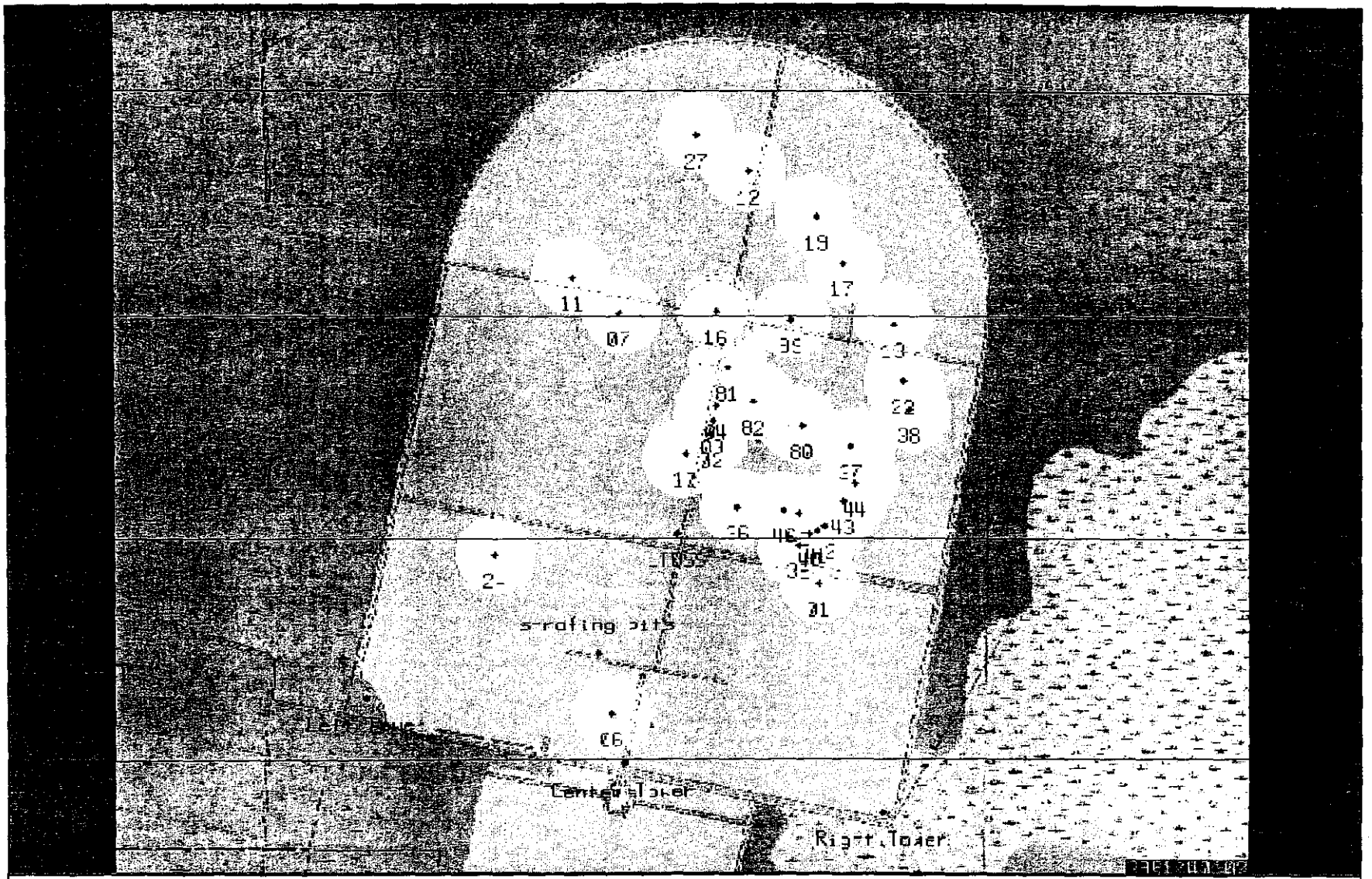


Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-11	Firing Position: Right Tower
Grid North	Laser Target Areas: (01)	Buffer Zone: 10 mrad



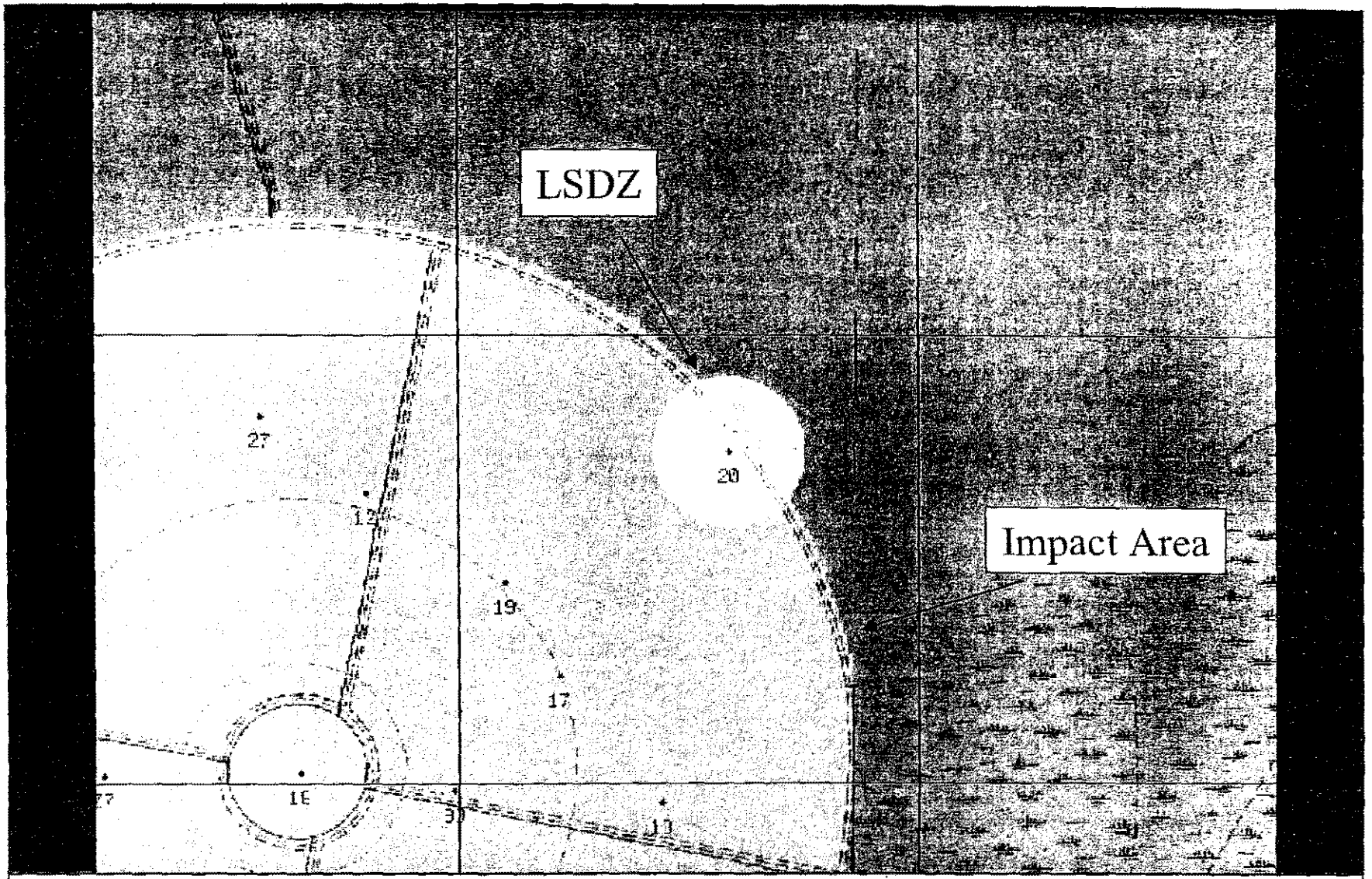
Dare County Range Man-Transportable Systems Laser Surface Danger Zones		
Scale: 1 square = 1000 m	Figure B-12	Firing Position: Right Tower
Grid North	Laser Target Areas: none	Buffer Zone: 15 mrad

Attachment 3: Dare County Range Aircraft-Mounted Systems Laser Surface Danger Zones



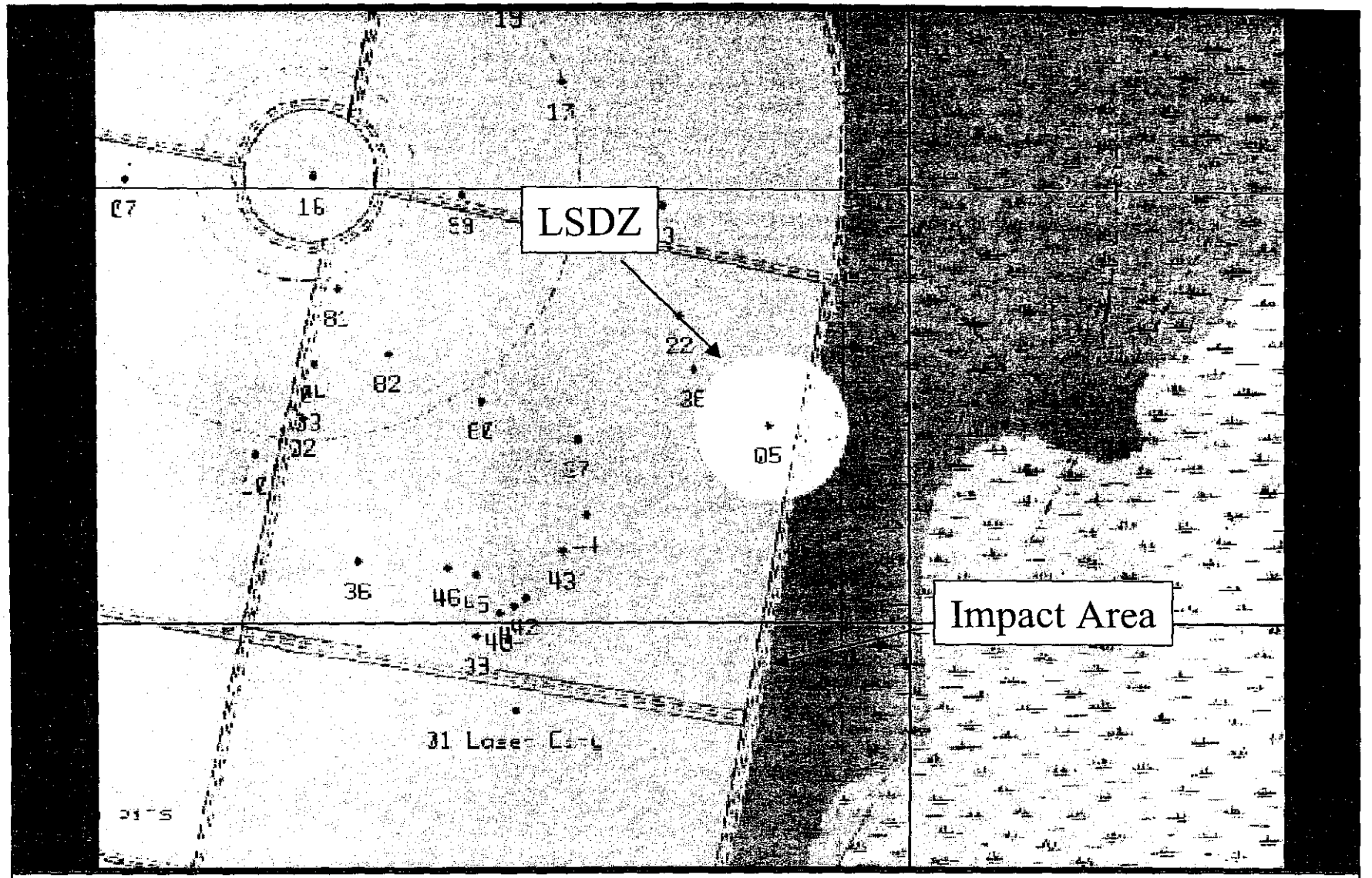
Dare County Range Laser Surface Danger Zones

Scale: 1 square = 1000 m	Figure C.1	Available Laser Headings: 000° to 360°
Grid North	Laser Target Areas: All (except 05 and 20)	Buffer Zone: 2 & 5 mrad



Dare County Range Laser Surface Danger Zones

Scale: 1 square = 1000 m	Figure C.2	Available Laser Headings: 000° to 360°
Grid North	Laser Target Areas: 20	Buffer Zone: 2 & 5 mrad



Dare County Range Laser Surface Danger Zones

Scale: 1 square = 1000 m	Figure C.3	Available Laser Headings: 000° to 360°
Grid North	Laser Target Areas: 05	Buffer Zone: 2 & 5 mrad

Attachment 4: Laser Radiation Injury Checklist

Every incident involving an alleged or suspected overexposure to laser radiation will be investigated and evidence of overexposure or injury (or absence thereof) documented (IAW AFOSH 48-139).

Whenever an alleged or suspected overexposure to laser radiation occurs, the following steps shall be taken:

Reporting

1.1 The supervisor will make sure that each exposed individual is taken immediately to the emergency room of the medical facility and examined by a qualified ophthalmologist / optometrist.

1.2 The supervisor will notify the unit LSO and unit Commander within eight hours.

1.3 The LSO will immediately notify local Bioenvironmental Engineering Services (BES). BES is required to notify the Tri-Service hotline (800-473-3549) within three duty days of any incidences.

1.4 LSO will complete the attached checklist with the assistance of the BES and forward it to:

AFIERA/SDRH 2402 E Drive Brooks AFB TX 78235	and	AFRL/HEDO 8111 Dave Erwin Brooks AFB TX 78235

LASER RADIATION INJURY CHECKLIST

RANGE/AREA NAME:

LSO:

NAME OF INJURED INDIVIDUAL:

DOB:

RANK/SSN:

LASER RADIATION INJURY CHECKLIST (cont.)

DATE/TIME OF ACCIDENT:

TYPE OF LASER/OPERATING PARAMETERS:

EXPOSURE ESTIMATE DETERMINED BY RECONSTRUCTION OF THE INCIDENT:

APPROXIMATE DISTANCE FROM THE SOURCE:

DID THE EXPOSURE RESULT FROM INTRABEAM VIEWING OR FROM A REFLECTION?

WERE OPTICAL INSTRUMENTS INVOLVED? YES / NO

LASER RADIATION INJURY CHECKLIST (cont.)

TYPE OF PROTECTIVE EYEWEAR WORN OR GIVE THE REASON FOR NOT WEARING PROTECTION:

BRIEF NARRATIVE DESCRIPTION OF THE INCIDENT:

NAME/RANK/ADDRESS AND PHONE NUMBER OF THE ATTENDING PHYSICIAN:

DETAILS OF IMMEDIATE MEDICAL FINDINGS: